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PHYSICS ABSTRACTS

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SCIENCE ABSTRACTS—SECTION A

EDITED AND ISSUED MONTHLY BY
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JANUARY, 1942

Vol. 45

No. 529

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1 Einstein spaces admitting the Lorentz group. SHABBAR, M. *Proc. Indian Acad. Sci. A*, 14, pp. 133-138, Aug., 1941.

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2 On the evolutes of anharmonic curves in a projective plane. TSUBOKO, M. *Proc. Phys.-Math. Soc., Japan*, 23, pp. 571-578, Aug., 1941.

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3 Intuitive and descriptive geometry of function space: the graphical representation of geometrical figures. RANDALL, M., AND LONGTIN, B. *J. Wash. Acad. Sci.*, 31, pp. 421-431, Oct. 15, 1941.

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4 The Calculation of $\arg \Gamma(ia + 1)$. BECKERLEY, J. G. *Indian J. Phys.*, 15, pp. 229-232, June, 1941.—A convenient, rapidly converging, finite-sum formula is derived for the numerical evaluation of $\arg \Gamma(ia + 1)$. This formula is then employed to construct a 4-place table of $\arg \Gamma(ia + 1)$ for $a = 0.1, 0.2, 0.3, \dots, 2.0$. The asymptotic formula is shown to be satisfactory for computing the function when $a > 2.0$.

517.611

5 On the solution of second-order differential equations satisfying boundary conditions. MORGANS, W. R. *Phil. Mag.*, 32, pp. 483-488, Dec., 1941.

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6 On the solutions of wave equations for non-vanishing rest-mass including a source function. SCHRÖDINGER, E. *Proc. Roy. Irish Acad. A*, 47, 1, pp. 1-23, Oct., 1941.

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7 The numerical solution of a type of equation. PLUMMER, H. C. *Phil. Mag.*, 32, pp. 505-512, Dec., 1941.

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8 The logic of probability. BERGMANN, G. *Amer. J. Phys.*, 9, pp. 263-272, Oct., 1941.

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9 A simple introduction to the use of statistics in telecommunications engineering. III. The Poisson probability law. DOUST, J. F., AND JOSEPHS, H. J. *P.O. Elect. Engrs' J.*, 34, pp. 139-144, Oct., 1941.—The present article discusses the fundamental principles of probability theory from the viewpoint of the Poisson probability law. A significance test is outlined. [See *Abstr.* 1448 B (1941)].

519.2 : 621.39

10 A rapid method for calculating the least-squares solution of a polynomial of degree not exceeding the

519.281.2

fifth. KERAWALA, S. M. *Indian J. Phys.*, 15, pp. 241-276, Aug., 1941.

ASTRONOMY

11 Distorted equilibrium configurations of a perfect compressible fluid mass. KROGDAHL, W. *Proc. Nat. Acad. Sci., Wash.*, 27, pp. 433-458, Oct. 15, 1941.—The methods used for determining the distortion of a polytrope under rotational and tidal forces are extended to compressible fluid configurations having any arbitrary pressure/density relations. Formal solutions are obtained to the hydrodynamical equations, and appropriate boundary conditions are applied to give actual solutions. The method applies generally, and the approximation is accurate to the first order in an appropriate perturbation parameter.

521.153

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12 Astronomical graph sheets. CAMPBELL, J. W. *J. Roy. Astr. Soc. Can.*, 35, pp. 353-355, Oct., 1941.

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13 Hypothesis as to the origin of cosmic rays and the experimental testing of it in India and elsewhere. MILLIKAN, R. A., NEHER, H. V., AND PICKERING, W. H. *Science*, 94, pp. 335-336, Oct. 10, 1941.—It is suggested that cosmic rays are produced in interstellar space by the occasional complete transformation of the rest-mass energy of atoms of He, C, N, O, and Si, each event creating either an electron pair or a proton pair. The spectral distribution of cosmic rays of measurable energy should thus consist of 5 bands, of energies 1.9, 5.6, 6.6, 7.5 and 13.2×10^9 eV, corresponding respectively to these atomic transformations. As the observer moves N. from the magnetic equator, each of these bands should begin to reach the earth at a particular latitude and continue reaching it at all more northerly latitudes. Between these critical latitudes there should be 4 plateaux of constant cosmic-ray energy. Observations made in India lend support to the hypothesis, though the C, N, and O bands have not been resolved.

523.165

A. HU.

14 North temperate Belt, markings on Jupiter in 1940-41. JOHNSON, H. M. *J. Roy. Astr. Soc. Can.*, 35, pp. 330-336, Oct., 1941.

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523.72 : 551.510.535 : 621.396.812.5

15 Solar phenomena preceding the ionospheric storm of March 1, 1941. DODSON, H. W., AND DIJKE, S. E. A. VAN. *Terr. Magn. Atmos. Elect.*, 46, p. 360, Sept., 1941.

523.74

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523.74 : 550.389.13 (794)

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Provisional sunspot numbers for May to July, 1941. BRUNNER, W. *Terr. Magn. Atmos. Elect.*, 46, p. 312, Sept., 1941.

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523.8.03 : 536.33

On a theoretical estimate of an upper limit of stellar diameters. SEN, N. R. *Indian J. Phys.*, 15, pp. 209–218, June, 1941.—Considering the stellar body as a polytrope whose index varies from shell to shell, an upper bound has been obtained, from the conditions of mechanical equilibrium, for the product (radial distance $\times$ temperature), when the min. value of the polytropic index and the max. value of the ratio of radiation to gas pressure within the gas mass are known. Taking the min. value of the index as approx. 1.5 and 3 for small and large stars, respectively, and defining the radius as the distance where the temperature falls to about 1 000 000°, the value of this radius is calculated in terms of the mass of the configuration, and also of the max. value of the ratio of the pressures. For stars of small masses these calculated rough upper bounds are not unsatisfactory, but for large masses they are rather too high.

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523.8.03 : 536.33

On some thermodynamic properties of a mixture of gas and radiation. SEN, N. R. *Indian J. Phys.*, 15, pp. 219–227, June, 1941.—Emden's theorem on the expansion or contraction of a polytropic gas mass with conservation of polytropic index has been extended to the case of a variable polytrope, which under similar conditions is shown to have the distribution of polytropic index unchanged. A relation is worked out between N and n , the polytropic indices for (P, ρ) and (p, ρ) relations, P being the total pressure and p the gas pressure. From this, a method is given for estimating the temperature distribution in a variable polytrope when its max. and min. polytropic indices are known.

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The world mapped in complementary segments. DUFTON, A. F. *Phil. Mag.*, 32, p. 436, Nov., 1941.—If the half of the sphere $x^2 + y^2 + z^2 = r^2$ for which x is positive is cut by the 2 parallel planes $2xz = r^2$, while the half for which x is negative is cut by the planes $2y^2 = r^2$, the surface is divided into 2 similar, equal, segments. These segments provide a suitable partition of the surface of the earth when the world is to be presented in 2 complementary maps. Two such maps are given, showing the world by an equal-area projection.

A. W.

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Calendar reform. WHITE, C. E. *J. Roy. Astr. Soc. Can.*, 35, pp. 343–352, Oct., 1941.

PHYSICS

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53 : 616.314

The rôle of physics in dentistry. GABEL, A. B.

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J. Appl. Phys., 12, pp. 712–717, Oct., 1941.—Discusses the mechanics of biting and chewing, and the advantages to the clinician of a knowledge of these. Other applications of physics are mentioned, including colour matching, the examination of teeth by polarized light and X-ray diffraction, and the therapeutic use of ultra-violet.

J. T.

GENERAL PRINCIPLES

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530.12

Relativistic field theories of elementary particles. PAULI, W. *Rev. Mod. Phys.*, 13, pp. 203–232, July, 1941.—A field is described in terms of functions $q^{(r)}$ of the co-ordinates x_i ($i = 1, 2, 3, 4$). A Lagrange function L is constructed from these functions and their derivatives $\partial q^{(r)}/\partial x_i$. The variation of L gives field equations. A tensor T_{ik} , with properties analogous to the energy-momentum tensor, is defined in terms of L and its derivatives. A skew-symmetric tensor, called the angular-momentum tensor, is defined in terms of T_{ik} , the co-ordinates, and the transforms of the $q^{(r)}$ under an infinitesimal Lorentz transformation. A current vector is also defined. External electromagnetic fields are introduced by substituting the operators $(\partial/\partial x_i) - ie\phi_i$ for $(\partial/\partial x_i)$ and gauge transformations are discussed. The bulk of the paper then consists of the discussion of special cases starting from the appropriate function L . Particles of spin 1, with and without external fields; Dirac's positron theory (spin $\frac{1}{2}$), and a synthesis of the theories for particles of spin 0 and 1 are all dealt with in this way. Finally, more specialized problems are discussed, such as the radiationless collision of mesotrons and electrons, the scattering of a light quantum, and the emission of a light quantum, by a mesotron in the field of a nucleus.

G. C. McV.

23

530.12

The gravitational equations of motion in relativity. NARLIKAR, V. V. *Proc. Indian Acad. Sci. A*, 14, pp. 187–195, Aug., 1941.—The author derives an equation for the geodesics in the field of 2 bodies. It is shown that when $m_1 = 0$ the equation reduces to that of the 2-body problem obtained without any reference to the geodesic postulate. Although Einstein's new method of deriving gravitational equations of motion is based on the field equations only, it can be consistent with the geodesic postulate if the field tensor tends to zero in a particular manner.

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Philosophy of physical science. EDDINGTON, A. S. *Nature, Lond.*, 148, pp. 692–693, Dec. 6, 1941.—Correspondence.

See Abstr. 26

530.12 : 531.18

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530.14

Reciprocity. VI. The wave function of the meson. SARGINSON, K. *Proc. Roy. Soc. Edinb.*, 61, 1, pp. 77–92, 1941.—A method is developed of writing the

wave function of the meson in 4-dimensional momentum space by analogy with the definitions introduced by Fuchs [Abstr. 716 (1941)]. There are, however, difficulties about defining the normalization. R. P.

MECHANICS

26 531.18 : 530.12
Special relativity in refracting media. MICHELS, W. C., AND PATTERSON, A.-L. *Phys. Rev.*, 60, pp. 589-592, Oct. 15, 1941.—A re-formulation of the Lorentz transformations for an observer in a refracting but non-dispersive medium is suggested. In this statement of the transformations the speed of light signals in the medium replaces the free-space speed which appears in the usual form. It is shown that the Fresnel drag coefficient takes the same form in the new formulation that it did in the old. Other consequences of this assumption are discussed and, in particular, the mechanics of the photon are shown to lead to correct expressions for Snell's law and for the pressure of radiation at the boundary of the medium.

27 531.224
Stresses in a rectangular knee of rigid frame. OSGOOD, W. R. *J. Res. Nat. Bur. Stand., Wash.*, 27, pp. 443-448, Nov., 1941.—Objection is taken to a previous theoretical analysis of the stresses, because in the limit a distribution of stress is obtained which does not appear reasonable. The author's analysis is largely free from this objection. G. E. A.

28 531.231
Moment-of-inertia experiments. RICE, JR., P. J. *Amer. J. Phys.*, 9, p. 312, Oct., 1941.

29 531.553
Some properties of the hodograph and their application in the construction of the hodograph in the problem of external ballistics. LEWIS, T. *Phil. Mag.*, 32, pp. 427-435, Nov., 1941.—Certain properties of the hodograph are proved generally. One of these properties leads to a quick and fairly accurate graphical method of constructing the hodograph for an arbitrary law of resistance, provided the ballistic coefficient remains constant. The method does not involve the construction of curves other than concentric circles, so that polar graph paper can be used whatever the value of the ballistic coefficient, provided it is constant. The method can be modified so as to take account of the variability of the ballistic coefficient due to variable atmospheric density.

30 531.7 : 538.652
An extensometer for the measurement of magnetostriction in sheet materials. BRAILSFORD, F., AND MARTINDALE, R. G. *J. Sci. Instrum.*, 18, pp. 221-223, Nov., 1941.—A combination of mechanical and optical levers provides magnification of about 100 000, enabling an extension of the order of 5×10^{-6}

to be directly measured and related to H and B . Its especial application is to transformer sheet steels.

E. H. W. B.

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31 531.7 621.3.085
Alloys for instruments. HUDSON, O. F. *J. Sci. Instrum.*, 18, pp. 211-216, Nov., 1941.—A review of alloys, particularly light alloys of Al and of Mg, of special use in instrument construction. Data include composition, tensile strength, elongation and Brinell hardness and metallurgical notes. Electrical-resistance materials, magnetic materials, heavy alloys for radium protection and alloys of very low temp. coeff. of expansion are also included. E. H. W. B.

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531.717 : 535.417

32 531.717 : 537.533.74
Determination of object thickness in electron microscopy. MARTON, L., AND SCHIFF, L. I. *J. Appl. Phys.*, 12, pp. 759-765, Oct., 1941.—For relatively thick specimens the thickness may in some cases be determined by profile observations on the edge of a broken and curled collodion film. In other cases stereoscopic observations taken at different viewing angles may be used. A third method, which is applicable to specimens so thin that multiple scattering can be neglected, is to compute the thickness from the measured intensity distribution of the electronic image. The total cross-section for single scattering of electrons outside the aperture angle of the electron microscope objective is calculated for fast electrons (energies greater than 10 000 eV) by means of the Born approximation for several cases of practical interest, and the results obtained are applied to experimental observations on metallic films and the structure of soap curd fibres. A. W.

33 531.733
A new type of micro-respirometer. TYLER, A., AND BERG, W. E. *Science*, 94, pp. 397-398, Oct. 24, 1941.—The oxygen consumption for quantities of fertilized stronglylocotrotus eggs, etc., may be measured with this apparatus which comprises a divided capillary tube, into the centre of which is introduced a hanging drop of liquid containing the specimen and an index drop of high b.p. kerosene. The relative spaces occupied by the 2 gas spaces are proportional to the oxygen consumption of the test specimen. E. H. W. B.

34 531.75 535.32 536.42
Physical constants of the normal paraffin hydrocarbons. DEANESLY, R. M., AND CARLETON, L. T. *J. Phys. Chem.*, 45, pp. 1104-1123, Oct., 1941.

LIQUIDS

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35 532.13

The viscosity function. III. Complete viscosity

range. IRANY, E. P. *J. Amer. Chem. Soc.*, 63, pp. 2611-2617, Oct., 1941.—The task of extending the functional viscosity scales beyond the limited range [Abstr. 4374 (1938)] has demanded rigorous criteria of ideality. Calorimetric, gravimetric, or cryoscopic evidence is too uncertain for complex substances of high viscosity, but very sensitive criteria have been made available by postulating the continuity of those principles and regularities which have been revealed in the lower ranges of the scales. An ideal mixture function and an ideal temperature function have been recognized as continuous and unique throughout the range of practical viscometry from about 0.1 to 5 000 centipoises. A fictitious "ideal liquid" is defined, capable of passing through all conceivable variations of the liquid state without limitation, and in accord with the fundamental law embodied in 3 viscosity scales derived from copious experimental data on paraffinic and naphthenic mineral oils.

H. H. HO.

36

532.522

Monomolecular films on a free jet of water. ISAKOVICH, M. A., AND RAISKY, S. M. *J. Phys., U.S.S.R.*, 4, 1-2, pp. 89-96, 1941.—Monomolecular films of surface-active substances can be obtained not only on the surface of water at rest but also under certain conditions on a free jet of water. This phenomenon can be observed when a jet strikes the surface of water spread with some surface-active substance which rises up along the jet, thus forming a stationary monomolecular tube through which the jet flows. The height to which the film rises on the jet depends on the pressure in the film and the friction between it and the water. Some experiments and calculations are described concerning the interaction of jet and film in a monomolecular tube covering the whole length of the jet, and the inflow of the jet in a tube which covers only a portion of the jet.

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532.525

On the velocity distribution of flow behind parallel rods. OKAYA, T., AND HASEGAWA, M. *Jap. J. Phys.*, 14, 1, pp. 1-10, 1940-1941.—Cordes' theory is reconsidered and modified so as to give results nearer to the experimental in a region nearer to the grid.

W. A. R.

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532.527

The distribution of velocity within a nest of tubes. WALLIS, R. P. *Engineering*, 152, pp. 361-364, Nov. 7, and pp. 401-403, Nov. 21, 1941.—In previous communications [Abstr. 657 B (1940)], the author has discussed the distribution of pressure and the character of the flow of fluid past tubes arranged rectangularly or in staggered formation. Pressure distribution in the flow have been determined by means of Pitot tubes and the results compared with results deduced from photographs of the motion. In particular, the spreading of the jet after it has passed the

first row of tubes is correlated with Tollmien's theory of the dispersal of air-jets issuing into free air; the "mixing length" is found to be 4 times greater in the case of flow past the nest of tubes.

J. S. G. T.

39

532.527 = 3

Dissipation theorem of turbulent motion of liquids. ARAKAWA, H. *Proc. Phys.-Math. Soc. Japan*, 23, pp. 535-538, July, 1941.

40

532.54

Mathematics of surge vessels and automatic averaging control. MASON, C. E., AND PHILBRICK, G. A. *Trans. Amer. Soc. Mech. Engrs*, 63, pp. 589-597; *Disc.*, 597-601, Oct., 1941.—The properties of surge vessels are considered from a functional point of view. The influence on these properties of externally applied controls is next discussed. Proceeding from the simpler to the more involved, control systems of various types are introduced and applied to a vessel. The performance of each of these applied systems is separately examined and illustrated under significant assumed conditions. Considerable attention is given to a definite method of control which involves, as the master instrument, one having a proportional-plus-floating characteristic, and which may be referred to as automatic averaging control.

41

532.574

An adjustable resistor for flowmeters. GOODEN, E. L. *Science*, 94, pp. 309-310, Sept. 26, 1941.

42

532.582

Velocity distribution in the boundary layer of an elliptic cylinder. OKAYA, T., AND HASEGAWA, M. *Proc. Phys.-Math. Soc. Japan*, 23, pp. 579-589, Aug., 1941.

43

532.583.8 : 532.64

Friction between a liquid surface and a solid not wetted by it. SUBRAHMANYAM, D. S. *Indian J. Phys.*, 15, pp. 191-208, June, 1941.—If the narrow uniform stem attached to an oscillating float is given a thin coating of paraffin wax, the oscillations are very quickly damped and the value of the logarithmic decrement increases as the amplitude decreases. The hypothesis is made that this is due to friction between the solid and the liquid, which is of the same nature as that between two solids in relative motion. Applying the analysis of vibrations damped by solid friction in addition to fluid friction to these oscillations, it has been possible to calculate the value, F , of the limiting kinetic frictional force per cm. of the line of contact. The values obtained with 3 stems, of dia. 0.246 cm., 0.296 cm. and 0.360 cm., have been found to be practically uniform: 15.36, 14.86 and 15.42 dynes/cm., respectively. It is also found that the value of this friction decreases at low velocities and that it is considerably reduced by contamination of the water surface. For rough surfaces it is found to be higher and, in addition, to show a rise

in value as the velocity increases. For palmitic acid F is found to be 17.02 dynes/cm., and for stearic acid 27.90 dynes/cm. These experiments confirm the hypothesis made by Adam and Jessop, in regard to the hysteresis of contact angle, that it may be the effect of a frictional force, F , operating along the solid surface with equal intensity as the liquid advances or recedes.

44 532.59

On the mechanical behaviour of liquids under high-frequency oscillations. OSIDA, I. *Proc. Phys.-Math. Soc. Japan*, 23, p. 667, Aug., 1941.—Errata [Abstr. 1144 (1941)].

45 532.612.4 : 539.133

Surface tension and molecular dimensions. GUNN, D. L., AND WALSH, B. M. *Nature, Lond.*, 148, pp. 566–567, Nov. 8, 1941.—An argument in support of the hypothesis that the molecules of long-chain compounds tend to stand up on end in their own liquid surfaces, just as they do on substrates, is advanced. An equation is deduced which indicates that the surface tension of such compounds is independent of chainwise association in the surface layer. The value of dS/dT (S = surface tension) for a series of alcohols is approx. constant, indicating that the molecular basal area is the same for all these compounds.

A. J. M.

46 532.613.4

The spreading of oils on water. II. Non-ionized molecules having only one polar group. ZISMAN, W. A. *J. Chem. Phys.*, 9, pp. 729–741, Oct., 1941.—[See Abstr. 1991 (1941)]. Experiments are described on the spreading upon water of drops of oil containing small amounts of alcohols, esters, ketones, phenols, non-ionized acids and non-ionized amines. It is shown that such polar molecules do not cause spreading unless the molal concentration exceeds a certain value which varies with the nature of the polar group, the chain length, the possible geometrical configurations of the molecule, and with the solubility in oil. The cause of their spreading is a reversible adsorption at the oil/water interface, associated with the osmotic pressure of the polar molecules dissolved in the oil. The average lifetime of adsorption of such molecules is a small fraction of that of ionized molecules. A_0 , the interfacial area per adsorbed molecule at the film pressure of 11.3 dynes/cm., is given for a considerable number of saturated and unsaturated straight- and branched-chain acids and alcohols. The observed changes of A_0 with chain length and polar group are explained on the basis of structural and kinetic considerations. Certain new spreading phenomena due to the formation of colloidal suspensions and crystalline precipitates of the polar compounds are described, and use is made of the latter to measure the solubility in oils of the various straight-chain saturated acids and alcohols.

47

532.613.4

Changes in the pressure of monomolecular films of stearic acid due to added drops of benzene. WASHBURN, E. R., TRANSUE, L. F., AND THOMPSON, T. J. *J. Amer. Chem. Soc.*, 63, pp. 2742–2745, Oct., 1941.—The times required for uniform drops of benzene to evaporate from monomolecular films of stearic acid in different states of compression on water are measured. The changes in pressure of the monomolecular films due to these spreading and evaporating drops are determined. Attempts are made to explain some of the observations in terms of changes in shape and condition of the drops, and in terms of solution of film in the drops and its subsequent redeposition.

48

532.613.4 = 3

On the interface tension of solutions against mercury. DUNKEN, H. *Z. phys. Chem. B*, 47, pp. 195–219, Oct., 1940.—While Langmuir's adsorption theory [Abstr. 1745 (1941)] was experimentally proved mainly with water as one of the interface partners, the present investigations refer to interactions between a metal (Hg) and solutions or pure substances. The method, which is described in detail, consists in counting and weighing the Hg drops issued from a capillary into the substance to be investigated. Mixtures of hydrocarbons and homologous or branched alcohols, and of a hydrocarbon (heptane) and CCl_4 , CS_2 and other substances, were investigated. At the interface between a dipole-free substance and a substance containing dipoles the former may be adsorbed. Relations were found between the nature of the polar group, its position in the periodical system, the chain length of the molecules and the value of the interface tension, of pure substances against Hg and of their interface activity in solutions. A linear relation was found between interface tension and friction coefficient.

R. N.

49

532.613.4 : 536.73 = 3

Thermodynamics of capillary activity of binary liquid mixtures with curved surfaces. DÖRING, W., AND NEUMANN, K. *Z. phys. Chem. A*, 186, pp. 193–202, May, 1940.—By means of the second law of thermodynamics the statements on capillary activity are derived in such a manner that they are applicable to any value of concentration of a binary liquid mixture and to any radius of curvature of the surface. By an appropriate choice of the surface separating the 2 phases the surface tension may be made independent of the curvature. Equations between measurable quantities are derived for the increase or decrease of molecules of the 2 components at the mixture surface. [See Abstr. 50 (1942)].

R. N.

50

532.63 = 3

Formation of droplets in supersaturated vapour mixtures of 2 completely miscible liquids. NEUMANN, K., AND DÖRING, W. *Z. phys. Chem. A*, 186, pp. 203–

226, May, 1940.—Previous investigations [Abstr. 49 (1942)] are used for improving on Flood's theory of the formation of droplets in binary vapour mixtures [Abstr. 5122 (1934)] by considering the influence of capillary activity. In investigating the composition of small mixed droplets the thickness of the adsorption layer and its derivation are calculated as functions of the molar fraction, and the germ formation is discussed. The trend of the curve representing the formation energy as a function of molar fraction, for small radii, shows 3 extreme values, one characterizing the normal germ, in which the v.p. of both components is in equilibrium with the gaseous phase, and the others accessory germs. The results of the calculations are compared with experimental results obtained for mixtures of water-alcohol vapours.

R. N.

See Abstr. 43

532.64 : 532.583.8

51

532.712 = 3

Maximum hydrostatic pressure in an osmometer with dry collodion diaphragm. LEPESCHKIN, W. W. *Z. phys. Chem. A*, 186, pp. 180–186, May, 1940.—With cane sugar solutions in an osmometer with dry collodion diaphragm the max. hydrostatic pressure at low concentrations was greater, and at high concentrations less, than the theoretical osmotic pressure at such concentrations and temperature. The ratio of the osmotic pressure to the max. hydrostatic pressure is greater the higher the concentration. The anomaly is explained as due to a low permeability for sugar of the dry collodion diaphragm, and to a decreasing permeability for water in sugar solutions with rising concentration.

R. N.

52

532.712

Isopestic measurements on solutions of potassium chromate and potassium dichromate. STOKES, R. H., WILSON, J. M., AND ROBINSON, R. A. *Trans. Faraday Soc.*, 37, pp. 566–569, Nov., 1941.—The osmotic and activity coefficients of K_2CrO_4 , determined by the isopiestic method, are very close to those of $Na_2S_2O_3$. This is consistent with the increase of atomic dimensions to be expected for these salts compared with K_2SO_4 and Na_2SO_4 . The osmotic coefficient of K_2CrO_7 is found to be anomalous, and an explanation is advanced in terms of a hydrolysis of the $Cr_2O_7^{2-}$ ion to the $HCrO_4^-$ ion. An approx. value of the equilibrium constant has been calculated.

53

532.712

The osmotic and activity coefficients of silver nitrate at 25°. ROBINSON, R. A., AND TAIT, D. A. *Trans. Faraday Soc.*, 37, pp. 569–570, Nov., 1941.

See Abstr. 109

532.771 : 535.557 : 532.1

GASES

54

533.15

Determination of diffusion coefficients. SERIN, B., AND ELLICKSON, R. T. *J. Chem. Phys.*, 9, pp. 742–

747, Oct., 1941.—Diffusion equations derived from Fick's law are discussed and applied to experimental data on the diffusion of oxygen in copper and on reaction rates for chemical reactions in the solid phase. Previous limitations on the applicability of the formulae are removed by the use of a simple graphical method so that the theory can be applied to data to which it was previously inapplicable. It is pointed out that the exact solution to Fick's law obtained is equivalent to the parabolic law in the early stages of the diffusion process. The activation energy for the diffusion of oxygen in copper is found to be 50–5 k. cal./g. atom.

55

533.177

Heat transfer from a flat plate. OKAYA, T., AND HASEGAWA, M. *Proc. Phys.-Math. Soc. Japan*, 23, pp. 454–464, June, 1941.—For turbulent fluid flow across a heated plate it is shown that the local heat transfer α is given by $\alpha = C_f/2 \{1 + (C_f/2)^{0.5} M(\sigma)\}$, where C_f is the local coeff. of friction and $M(\sigma)$ is a function of Prandtl's number σ . $M(\sigma)$ is determined from the data of Schultz-Grünow (*Luftfahrtforschung*, 17, 239, 1940) and, when σ does not differ greatly from unity, the mean heat transfer coefficient α_m is given approx. by $\alpha_m = C_D \left[\frac{1}{2} - \frac{4\phi}{7} + \frac{4\phi^2}{6} - \frac{4\phi^3}{5} \right]$, where $\phi = (0.4C_D)^{0.5} M(\sigma)$, C_D being the mean coeff. of friction.

R. W. P.

56

533.6.013.42

The vibration and sound of a revolving thin plate. (Acoustical model of airscrew flutter.) (Investigations of airscrew flutter. III.) OBATA, J., YOSIDA, Y., AND MAKITA, Y. *Rep. Aero Res. Inst. Tokyo*, No. 206, pp. 129–163, April, 1941.—Tests were made on a thin straight strip of duralumin in place of an airscrew. As the speed of its rotation is increased, a peculiar sound is abruptly emitted at a certain speed. With further increase of speed the sound ceases, to begin again at a still higher speed. For a number of strips, in all cases, the excited vibrations were torsional. Records of the analyses of the sounds and vibrations are given. The flutter sound is found to consist of components of the sound of rotation, components of the sound due to vibration, and combinational tones of these two. Very often the intensities of the combinational tones are greater than those of their primaries. Polar curves indicate the space distribution of the amplitudes. The sound of rotation has a max. in the plane of rotation; the sound due to torsional vibration has a max. in a perpendicular plane; and the combinational tone of these two has a max. in an intermediate plane. Records of the wave forms of the flutter sounds are given. The amplitude of the torsional vibrations diminishes with decrease of atmospheric pressure, and the fluttering range widens logarithmically with increase in the speed of rotation. Contrary to the

case of the aircrew, increase of the angle of incidence of the blades reduces the flutter, which apparently disappears at an angle of incidence of 30° . G. E. A.

57 533.65

The characteristics of the aerofoil with discontinuities along the span, with special reference to the effects of cut-out. OKAMOTO, T. *Rep. Aero. Res. Inst. Tokyo*, No. 208, pp. 207-263, May, 1941.—The paper deals theoretically with the aerofoil with discontinuities along the span, as, for example, an aerofoil with rectangular cut-out flap or aileron. The approx. method of calculating the lift distribution of the aerofoil with discontinuities is obtained, and it is shown that the method may be used with satisfactory accuracy. The characteristics of the aerofoil with longitudinal slots are studied, and the special cases of the divided aerofoil and aerofoil with cut-out are solved. The calculated results agree satisfactorily with the measured results. G. E. A.

SOUND. VIBRATIONS

58 534.01

The admittance method for obtaining the natural frequencies of systems. DUNCAN, W. J. *Phil. Mag.*, 32, pp. 401-409, Nov., 1941.—The method, due to Carter, has its field of usefulness defined in this paper. The admittance, e.g. of a system of fly-wheels on an elastic shaft to one end of which a sine couple of amplitude Q is applied, is θ/Q , where θ is the angular amplitude of the motion at the end mentioned. The definition is extended to a general dynamical system; the admittance characteristic is the relation or curve connecting admittance and frequency. The method is applied in a simple case and extended to less simple cases. Some examples of admittances of elastic and massive bodies are given, which can be obtained by elementary methods. Examples of the use of admittances are followed by a list of the types of systems which can be treated by the simple form of the method. G. E. A.

See Abstr. 288 534.01 : 548

See Abstr. 62 534.11 + 534.13 : 534.321.4

59 534.15 : 788.3

Vibration of the walls of a cornet. KNAUSS, H. P., AND YEAGER, W. J. *J. Acoust. Soc. Amer.*, 13, pp. 160-162, Oct., 1941.—Vibrations of the metal walls of a cornet were studied with a crystal pick-up and a cathode-ray oscillograph. For each tone of the scale the walls were set into vibration at the frequency of the tone played. This vibration was duplicated by electromagnetic driving, and the sound produced by the walls alone was compared with the tone of the cornet as played, by means of a sound-level meter. The intensity difference shows that the contribution of the walls is masked completely by that of the vibrating air column. This was checked by loading

the walls of a bugle with putty; its tone quality could hardly be distinguished from that of an untreated bugle.

60 534.22

Demonstrating the Doppler effect. HEAPS, C. W. *Amer. J. Phys.*, 9, p. 313, Oct., 1941.

61 534.241

The flutter echoes. MAA, D. Y. *J. Acoust. Soc. Amer.*, 13, pp. 170-178, Oct., 1941.—Fluttering is the transient vibration excited by short sound pulses between two parallel walls. To an observer near one of the walls the flutter echoes always sound as if they originate from the farther wall. In this paper the phenomenon of fluttering is considered theoretically, both by the normal-mode technique and by the method of geometrical acoustics. Both methods predict a series of multiple echoes. This is verified experimentally by taking the oscillogram of the flutter echoes. The directional effect of the fluttering is explained by psychological reasons.

62 534.321.4 : 534.13 + 534.11

Harmonic relations in the partials of organ pipes and of vibrating strings. NOLLE, A. W., AND BONER, C. P. *J. Acoust. Soc. Amer.*, 13, pp. 145-148, Oct., 1941.—Experiments were made to determine whether the partials present in the tones of open-flue organ pipes and of strings were harmonic. In the case of pipes the frequencies of 2 partials were compared with the aid of a cathode-ray oscilloscope, and as the epoch angle of the Lissajous figure showed no progressive change for several minutes it was concluded that the first 4 partials studied were harmonic. This result was confirmed by two other methods. The sound emitted by a steel wire loaded at one end and resting on 2 bridges was examined by a similar method in the steady and transient states. In the former case the first 4 partials were harmonic, but when the string was bowed or plucked, and then left to vibrate freely, the epoch angles between the partials varied rapidly. The possibility of anharmonic relations between the partials of a freely vibrating string was thus confirmed. G. E. A.

63 534.321.9

An explanation of the diminished acoustic velocity in fluids at high frequencies. RAO, B. V. R., AND RAMAIA, D. S. S. *Phys. Rev.*, 60, p. 615, Oct. 15, 1941.

64 534.322.3

A re-examination of the noise-reduction coefficient. PARKINSON, J. S., AND JACK, W. A. *J. Acoust. Soc. Amer.*, 13, pp. 163-169, Oct., 1941.—It is the practice to call the average of the sound-absorption coeff. at 256, 512, 1 024 and 2 048 c/s. the noise-reduction coefficient, in an effort to assign a single figure to an absorbing material, which will be useful in judging its performance in a noise-quieting problem. Typical

noise spectra are presented and analysed for reductions that can be expected in each frequency band. It appears that, if a single figure is to be assigned, the absorption coefficient at 4096 should also be considered. This is particularly true of office quieting, which is an important field of commercial noise control. In factories where heavy machinery is operating, it appears advisable to give some weighting to 128 c/s.

65

534.323 : 621.317.784

The acoustic wattmeter, an instrument for measuring sound-energy flow. CLAPP, C. W., AND FIRESTONE, F. A. *J. Acoust. Soc. Amer.*, 13, pp. 124-136, Oct., 1941.—[Abstr. 94 B (1942)].

66

534.323.1

Loudness and intensity. HAM, L. B. *Amer. J. Phys.*, 9, pp. 213-216, Aug., 1941.—A statement of the present-day relation between loudness and intensity. The Weber-Fechner logarithmic law (1860) was, in 1928, not considered exact, and many of the definitions in physics textbooks are faulty. The definitions of the above quantities adopted by the American Standards Association are stated. Further, the intensity level of any frequency or complex sound is measured in db above the base reference level of 10^{-16} W/cm.² or 0.0002 dyne/cm.², and the loudness level of any frequency or complex sound is defined as the loudness level of the equally loud 1000 c/s. reference tone, and is expressed in phons. The measurement of loudness is based on the mental estimates of many typical observers, and a curve is given in which the loudness is related to the loudness level of the reference tone in phons. The two quantities are not proportional, but, for the middle frequencies, may be related by the equation: $L = e^{0.076N}$, where N is $10 \log I/I_0$, and I_0 is the intensity reference level, or the loudness is nearly proportional to the cube root of the intensity. Another graph gives equal-loudness contours in phons as these vary with frequency. In general, intensity levels and phon levels do not agree numerically except at 1000 c/s. The relations between intensity and loudness are actually more involved than as shown by the graphs.

G. E. A.

67

534.37 : 621.395.623

Measurement of acoustical impedances. KANTA, C. *Indian J. Phys.*, 15, pp. 161-171, June, 1941.—[Abstr. 149 B (1942)].

68

534.41 : 788.3

Resonance characteristics of a cornet. WOODWARD, J. G. *J. Acoust. Soc. Amer.*, 13, pp. 156-159, Oct., 1941.—The resonance of a B_♭ cornet was measured over a wide range of frequencies and for all combinations of open and closed valves. An a.f. oscillator and headphone were used as the source of sound and a sound-level meter was the indicating device. About 20 regions of resonance were found, all below 2 500 c/s.

69

534.43

A two-side non-turnover automatic record changer. CARSON, B. R. *RCA Rev. [Radio Corp. Amer.]*, 6, pp. 183-189, Oct., 1941.—A new simple design is described. It does not require the record to be turned over to play the second side. This is accomplished by the use of a tandem tone arm and 2 pick-ups with reversal of the direction of record rotation for the playing of the underside.

70

534.75

A cinematographic study of the conduction of sound in the human ear. KOBRAK, H. G. *J. Acoust. Soc. Amer.*, 13, pp. 179-181, Oct., 1941.

71

534.75

The effect of middle ear pressure upon distortion. WEVER, E. G., BRAY, C. W., AND LAWRENCE, M. *J. Acoust. Soc. Amer.*, 13, pp. 182-187, Oct., 1941.

72

534.812

Mechanical and optical equipment for the stereophonic sound film system. WENTE, E. C., BIDDULPH, R., ELMER, L. A., AND ANDERSON, A. B. *J. Acoust. Soc. Amer.*, 13, pp. 100-106, Oct., 1941.—The same mechanism is employed for propelling the film in both recording and reproducing. To permit recording of the longer orchestral selections without interruption, the machines are designed to handle film in 2 000 ft. lengths. Special features of the film-propulsion system for obtaining great uniformity of speed at the translation points are described. The 3 signal- and 1 control-channel currents are recorded by means of light valves of identical construction. All 4 tracks are exposed while the film is passing over a free-running supporting roller, mounted on the same shaft with a new type of internally damped roller. In reproduction each track is exposed, through an objective of high aperture, to light from an incandescent source. After passing through the film, the light from each track is carried by a glass rod to a photo-electric cell.

73

534.812

The stereophonic sound film system—pre- and post-equalization of compandor systems. STEINBERG, J. C. *J. Acoust. Soc. Amer.*, 13, pp. 107-114, Oct., 1941.—In order best to fit the volume range of the programme material into the volume range available in sound film, it is generally advantageous to equalize the programme material before recording and to compensate for the equalization by means of a complementary post-equalizer on reproduction. The type and amount of pre-equalization depends upon the properties of hearing and on the characteristics of the programme material and the film noise. This paper discusses the relations between these quantities for systems using compandors, where the film noise varies up and down in level as the compandor gains vary. Ideally, different types of pre-equalization are needed for different types of programme material,

and a compromise must be made if a single type is to be used. The considerations leading to the choice of the pre-equalization used in the stereophonic recording and reproducing system are discussed.

LIGHT

74

535.14

On the scattering of light by mesotrons. LANDAU, L., AND SMORODINSKI, J. *J. Phys., U.S.S.R.*, 4, 5, pp. 455-460, 1941.—Landau's criterion is used for estimation of cross-sections for high energies for the following processes involving mesotrons: (1) Compton effect on a mesotron, (2) mesotron pair production by a collision of 2 photons, (3) Coulomb scattering of mesotrons. These cross-sections do not increase with energy, as they do when calculated by means of perturbation-theory methods.

75

535.215 : 539.164.9 : 3

Photo-electric conductivity of ZnScu phosphors under the influence of α -rays. LAPPE, F. R. *Ann. Phys., Lpz.*, 39, 8, pp. 604-618, 1941.—Photo-electric measurements are carried out on ZnScu phosphors, undecomposed, and decomposed under the influence of α -rays, and are extended to the secondary current, the quenching effect being determined. For measurable and reproducible photo-currents the thinnest phosphor layers are necessary. In this way the photo-currents obtained with relatively small voltages are 1 000 times as great as the dark current. The decay period of the photo-current falls off with the voltage, while the current change remains constant. The quenching effect on the phosphor under steady excitation, measured as current decrease, is remarkably sluggish. The phosphorescence which exists with the quenching to a much lesser degree can be observed electrically as a brief current increase on starting the long-wave exposure. The current decrease by quenching tends to a saturation value similar to that of excitation. The excitation of the phosphor by current under the irradiation by the α -rays is strongly dependent on time. The effect on this current of the simultaneous destruction of the centres shows a nearly linear increase. The quenching effect on the secondary current also increases linearly with the decomposition; it occurs equally for all the wavelengths used. The ratio blue/white grows linearly with the decomposition [see Abstr. 2114 (1940)]. The speed of decay and the speed of the quenching effect both increase in proportion to the decomposition. Considerable dependence on pressure of the secondary current is established, and this is checked with the rare gas Kr. The dark current and the photo-current increase markedly with reduced gas pressure, owing to the effect of adsorbed gas on the passage of the electrons between the micro-crystals. With falling gas pressure the quenching effect shows a drop; on the other hand, the half-value periods of

the growth and decay of the photo-current remain completely constant.

H. G. S.

76

535.215.2 = 3

Secondary electrons from highly photo-electric semi-conductors. WOLFF, H. *Ann. Phys., Lpz.*, 39, 8, pp. 591-603, 1941.—The work concerns the secondary emission from substances having marked inner photo-electric properties. The effect of the insulating power of substances on the results of measurements carried out with Pt dusted on molten quartz is investigated. It is found that negative auxiliary voltages compensate the effect of the charge and yield reliable n -values (emission factor). With the arrangement used, which is fully described, the emissive power as a function of the primary energy can be measured, but velocity data from opposed-field measurements with insulators cannot be obtained. Se is investigated in various modifications, and Se photo-cells in which the relative thicknesses of the cover electrodes are known. With Se a modifying effect is produced, and it is shown that dusted from vitreous Se the Se is deposited in the black modification. The influence of the cover electrode is systematically tested. Besides an increase in the emissive power with thicknesses which are not too great, there is a steady transition of the Se curve to that of Au. The observed opposed-field measurements indicate an almost equal relative distribution on all the layers investigated and for all the primary energies. No clear influence of the photo-electric properties on the emissive power and on the velocity distribution is discernible. Cd-selenide phosphors are also investigated. Despite certain differences in their properties, mainly specific conductivity, these layers behave alike towards electron bombardment. With un-annealed and annealed base material the results show that the annealing process affects the emissive power more than does the Cu content. Here also all the layers exhibit close similarity in the velocity distribution of the secondary electrons.

H. G. S.

See Abstr. 289

535.215.4 : 548

77

535.215.5

Note on the photo-electric threshold of bismuth films of measured thickness. WEBER, A. H., AND EISELE, L. J. *Phys. Rev.*, 60, pp. 570-573, Oct. 15, 1941.—The photo-electric threshold wavelength change with thickness in aged Bi films deposited on pyrex at room temperature in vacuum is investigated further with some important modifications in apparatus and method including measurement of the average film thickness and extension of the temperature range [Abstr. 3421 (1938)]. The data show that the Bi films are characterized by: (1) an initial value of the threshold wavelength (2 497 Å average) fairly independent of film thickness for the first 44 atom layers; (2) a definite shift towards higher threshold wavelengths occurring between 44 and 111 atom layers

thickness; followed by (3), a steady increase of threshold wavelength with film thickness above about 111 atom layers. These results are in general agreement with the previous preliminary work but show some differences which are discussed briefly.

78

535.215.5

Electrical conductance and photo-electric emission of thin bismuth films. WEBER, A. H., AND O'BRIEN, D. F. *Phys. Rev.*, 60, pp. 574-578, Oct. 15, 1941.—The electrical conductance and photo-electric emission of Bi films on pyrex have been simultaneously measured as functions of average film thickness. The films, evaporated always at the rate of 1.11 atom layers/min. in vacuum, were condensed under 3 different conditions; continuously at liquid-air temperature, discontinuously at room temperature, and continuously at room temperature. For all films the conductance and photo-electric emission increase abruptly and nearly together at some film thickness, dependent on the temperature of condensation and ageing of the film. The agglomeration of mobile condensed atoms satisfactorily explains the results but the process is complex with the condition of the backing surface a likely influencing factor. No photoconductive effect was observed. Various experiments on the variation of conductance v. temperature are in agreement with the results of Fukuroi.

79

535.215.5 : 621.383.5

The drift of the selenium barrier-layer photocell. HOUSTOUN, R. A. *Phil. Mag.*, 31, pp. 498-506, June, 1941.—Fatigue and recovery tests were made with an old and a new photonic cell, a recent English cell and a cell of German origin. The experiments affirm that the sensitivity of a cell to green light is impaired when it has been fatigued in red light, and vice versa. Cells of different origin behaved differently with regard to fatigue and especially with regard to the intensity of light necessary to produce the effect. The Se barrier-layer cell is also liable to irregular behaviour, although considerably less so than the ordinary Se conductivity cell. R. N.

See Abstr. 132

535.23 : 537.122

See Abstr. 3

535.24 : 515.91

80

535.243

A new microphotometer. VINCENT, H. B., AND SAWYER, R. A. *J. Opt. Soc. Amer.*, 31, pp. 639-643, Oct., 1941.—This is a special-purpose instrument for the quantitative determination of the component spectral lines of steels. A photographic plate carrying the test spectrum is set up above a reference spectrum plate and the transmitted light collected from the region required and focused on to a metal photocell. A galvanometer indicates the relative intensity on a screen for visual readings to be made and plotted. Great precision is claimed.

E. H. W. B.

81

535.245

The integrating sphere. MOHLER, N. M. *Amer. J. Phys.*, 9, pp. 229-232, Aug., 1941.—Describes the construction of a sphere 16 in. in dia., suitable for the use of students in a photometric laboratory. Experiments performed with it include a study of the sensitivity of the eye to difference of energy distribution in the absence of colour difference. J. W. T. W.

See Abstrs. 138, 139

535.3 : 537.531

See Abstr. 291

535.3 : 548 : 537.531

See Abstr. 34

535.32

82

535.323.2 = 3

On the choice of correct values for the refraction index of NaCl and KCl in the infra-red. JURJEV, M. A., AND FOMIN, A. E. *J. Phys., U.S.S.R.*, 4, 5, pp. 461-462, 1941.

83

535.33 = 3

A spectral theory. NAKANO, H. *Proc. Phys.-Math. Soc. Japan*, 23, pp. 485-511, July, 1941.—A theory is developed mathematically. W. R. A.

84

535.33.07

An infra-red spectrometer for industrial use. AVERY, W. H. *J. Opt. Soc. Amer.*, 31, pp. 633-638, Oct., 1941.—The paper describes a new spectrometer designed for industrial use where speed, convenience and ruggedness, as well as accuracy, are of importance. Some applications of the instrument to the analysis of petroleum fractions are also presented.

A. H.

85

535.33.07

Applications of the spectrograph to toxicological investigations. RANKIN, C. W. *J. Opt. Soc. Amer.*, 31, pp. 644-647, Oct., 1941.

86

535.331

Spectrochemical analysis of duralumin type alloys. CHURCHILL, H. V., AND CHURCHILL, J. R. *J. Opt. Soc. Amer.*, 31, pp. 611-619, Oct., 1941.—This paper describes the routine analytical work being carried out by the 15 spectrographic laboratories of the Aluminum Co. of America. A general description of the work is given, with a detailed account of the determination of Cu in Al alloys. A. H.

87

535.331

A spectrographic analysis of iron for tellurium. HACKETT, J. W., AND NUSBAUM, R. E. *J. Opt. Soc. Amer.*, 31, pp. 620-626, Oct., 1941.—The presence of Te in Fe means a great reduction in annealing time and the possibility of casting much larger sections. Such use of Te requires analyses for concentrations ranging from 0.001 to 0.01 %. A h.v. a.c. arc between metal electrodes is employed, the electrodes rotating during the exposure. The analysis line is $\lambda 2385.76$ and the instrument employed must be capable of resolving this line from Fe $\lambda 2385.58$ and 2385.95 . The presence of Cr, V and Co, would interfere since these elements radiate lines which interfere with

the Te line. The spectrographic method is the only method which provides the speed and accuracy required in a production analysis, and analyses are reproducible within 5%.

A. H.

88

535.331

Spectrochemical determination of lead, cadmium and zinc in dusts, fumes and ores. OSHRY, H. I., BALLARD, J. W., AND SCHRENK, H. H. *J. Opt. Soc. Amer.*, 31, pp. 627-633, Oct., 1941.—A spectrochemical method is described for the determination of Pb, Cd and Zn in samples of dusts and fumes collected with the Barnes electrostatic precipitator. The technique involves the use of solutions containing an internal standard and a spectroscopic buffer. The spectra are photographed through a step sector and measured with a non-recording photo-electric densitometer. Practical application is made of the method in the analysis of air-borne dusts and fumes and Zn ores and spelters.

A. H.

89

535.338

Resonance perturbations in the spectra of diatomic molecules. STEPANOV, B. I. *J. Phys., U.S.S.R.*, 4, 5, pp. 411-421, 1941.—The resonance interactions of levels ${}^2\Pi \times {}^2\Pi$, ${}^3\Pi \times {}^3\Pi$, ${}^1\Pi \times {}^3\Pi$, ${}^1\Sigma \times {}^3\Pi$ of the diatomic molecule are considered. Formulae are derived for the matrix elements of interaction, and perturbation curves are plotted. Tables are compiled to show the resonance interaction of levels of any multiplicity.

90

535.338

A study of the Raman effect in seventeen optical glasses. NORRIS, R. *Proc. Indian Acad. Sci. A*, 14, pp. 178-186, Aug., 1941.

91

535.338

Raman spectra of cyclopentane and some of its monoalkyl derivatives. ROSENBAUM, E. J., AND JACOBSON, H. F. *J. Amer. Chem. Soc.*, 63, pp. 2841-2842, Oct., 1941.

92

535.338

The strongest lines of singly ionized atoms. MEGGERS, W. F. *J. Opt. Soc. Amer.*, 31, pp. 605-611, Oct., 1941.—[See Abstr. 591 (1941)].

93

535.338

Intensities in perturbations. DIEKE, G. H. *Phys. Rev.*, 60, pp. 523-529, Oct. 1, 1941.—Quantitative formulae for the intensities of lines from a pair of interacting states to a common lower state are applied to perturbations in band spectra. It appears that rotational and vibrational perturbations show quite a different behaviour. In the former there is a direct superposition of intensities of the 2 interacting states, whereas in the latter interference effects give an entirely different picture. The general formulae are applied to a few cases in the H_2 spectrum.

See Abstr. 140

535.338 : 537.531

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94

535.338 : 539.153

Rotational analysis of the 2 900 Å band of CO_2^+ . BUESO-SANLLEHÍ, F. *Phys. Rev.*, 60, pp. 556-570, Oct. 15, 1941.—A rotational analysis of the CO_2^+ doublet band near $\lambda 2896$ and $\lambda 2882$ has been made. The band was photographed in the third order of the 30 ft. grating spectrograph at Ryerson Laboratory with a dispersion of 0.22 Å/mm. and a resolving power of 300 000. The structure is explained by a ${}^2\Sigma_u^+ \rightarrow {}^2\Pi_g$ (case a, inverted) transition, where the ${}^2\Pi_g$ is the ground state of CO_2^+ . Alternate lines are missing as expected for ${}^2\Sigma$ in view of the zero spin of the oxygen nuclei. A number of perturbations are observed, which involve displacements and weakening of the lines. The values found for the molecular constants of the lower ${}^2\Pi_g$ state agree with those found by Mrozowski.

95

535.34 = 3

Tentative explanation of light absorption of unsaturated compounds in long-wave ultra-violet and in visible regions by oscillations of electron clouds. HENRICI, A. *Z. phys. Chem. B*, 47, pp. 93-126, Sept., 1940.—The characteristic oscillation of the cloud consisting of p -electrons of unsaturated molecules is determined, being similar to the oscillations of the plasma in gas discharges. The formula $\lambda = 334.2 \sqrt{V s_1}$ is derived, where λ is the wavelength of the absorption band with longest wave, V the space filling factor, i.e. the inverse of density, and s_1 an anisotropic weakening factor analogous to the dielectric const. The formula is applied to the homologous series of carbocyclic compounds: benzene, naphthalene, anthracene, naphthacene and pentacene. With $s = 1$ an estimation is made for the values of V , partly from X-ray measurements of mol. distances, partly from the observed positions of the absorption bands under the assumption of an ellipsoidal distribution of the charge. Although the expected red shift of absorption is found for the higher homologues, there are increasing deviations in the direction of shorter waves. The anisotropy of the s -values is taken into consideration, and the results of the calculations are discussed.

R. N.

See Abstr. 113

535.34 : 535.81

See Abstr. 194

535.34 : 539.217.3

See Abstr. 260

535.34 : 541.182.63 : 538.615

See Abstr. 279

535.34 : 541.8 = 3

96

535.343.2

The infra-red absorption and reflection spectra of KHF_2 and of KDF_2 . KETELAAR, J. A. A. *J. Chem. Phys.*, 9, pp. 775-776, Oct., 1941.

97

535.343.3 : 539.153

A rotational analysis of some CS_2 bands in the near ultra-violet system. LIEBERMANN, L. N. *Phys. Rev.*, 60, pp. 496-505, Oct. 1, 1941.—Six bands in the $\lambda 3100$ system of CS_2 , photographed in absorption on a 30 ft. grating spectrograph, have been analysed and

B values are given for their initial and final states. The band structure is of the simple PR branch type, all of the observed bands originating from $^1\Sigma_u^+ - ^1\Sigma_g^+$ transitions. A perturbation analysis gives constants which are in good agreement with observation and in addition gives the B value for the perturbing $^1\Pi_u$ state. Evidence indicates that the excited electronic state of CS_2 is bent. It is shown that, even if the molecule is bent to 125° , the P and R series may still be represented by a simple quadratic formula, exactly as for a linear molecule, for J values less than 25.

See Abstr. 171

535.343.3 : 539.153

See Abstr. 258

535.343.3 : 541.182.6

98

535.37

On the law of decay of luminescence of complex molecules. TUMERMAN, L. A. *J. Phys., U.S.S.R.*, 4, 1-2, pp. 151-166, 1941.—The law of decay of the luminescence of solutions of complex organic substances (dyes) is experimentally investigated in a temperature range of $+20^\circ$ to -107° . It is shown that at comparatively high (room) temperatures the law of decay can with sufficient accuracy be considered as exponential: $\Phi(t) = E_0/\tau \cdot e^{-t/\tau}$. With a lowering of the temperature a considerable increase is observed in the average time during which the molecule remains in the excited state. Analysis of the experimental data shows that this is not due to a simple increase in the value of τ in the exponential law of decay, but is connected with a change in the law itself. The period of exponential decay of the luminescence is preceded by a dark pause, during which an increase in the fluorescence takes place. The duration of the dark pause is very small in comparison with τ at room temperatures and increases very rapidly with a lowering of the temperature. This dark pause is interpreted as the time of rebuilding of the molecule after absorption of light. It is shown that quenchers (KI, aniline) added to the solution in extremely small concentrations (in which the effect of quenching is practically not yet absorbed call forth an abrupt shortening of the dark pause and almost destroy the influence of the temperature on the law of decay of the fluorescence and on the average duration period of the excited state of the molecules.

See Abstr. 290

535.37 : 548

99

535.371

On the polarization of fluorescence of some simple aromatic hydrocarbons in solution. CHAKRAVARTI, D. C., AND GANGULY, S. C. *Trans. Faraday Soc.*, 37, pp. 562-566, Nov., 1941.—The polarization of the fluorescence of anthracene, phenanthrene, naphthalene, chrysene and perylene, in glycerol has been obtained. Within the range of the experiments, the polarization is practically the same for all the fluorescent bands of these substances, and is inde-

pendent of the frequency of the incident light. For all the substances examined the polarization at -79° is 41-44%, and the limiting value for an infinitely viscous solution is probably 50%. A. J. M.

100

535.375 = 3

On destruction of strontium sulphide. STRECK, E. *Z. phys. Chem. B*, 47, pp. 220-226, Oct., 1940.—The effect of humidity and light on pure SrS and on SrS phosphors is investigated. While the pure substance undergoes only slight changes, a marked change of colour and of the phosphorescent quality of the phosphors was observed. Water appears to act as a catalyser, with dry preparations no changes take place. The chemical reactions underlying this behaviour are tentatively stated. For preserving the phosphorescent quality of the substances under atmospheric influences a lacquer based on a natural resin showed the best results.

R. N.

101

535.39

On the theoretical intensity curves of the three halos obtained from thin films of organic substances in amorphous state by electron diffraction. KAKINOKI, J. *Proc. Phys.-Math. Soc. Japan*, 23, p. 666, Aug., 1941.

See Abstr. 141

535.4 : 537.531

See Abstr. 290

535.4 : 548

102

535.41

Phenomenon of fringes in a purely corpuscular theory of light. SERGHIESCO, S. T. *J. Opt. Soc. Amer.*, 31, pp. 550-554, Aug., 1941.—Continues the author's analysis [Abstr. 1795 (1941)] of the possibility of explaining interference fringes on a purely corpuscular theory of light, the transmitting and reflecting layers being assumed to have a lattice structure. Localized fringes in transmitted light and the non-localized fringes of the Fresnel mirrors and the Fresnel biprism are here dealt with.

W. S. S.

103

535.417 : 531.717

Use of ultra-violet source for interferometer measurements of thickness of thin metallic films. CLARK, J. C., AND FRITZ, N. L. *Rev. Sci. Instrum.*, 12, pp. 483-484, Oct., 1941.—A method is described for measuring the thickness of thin metallic films, using $\lambda = 3\,654\text{ \AA}$ filtered from the Hg arc spectrum as the source of light for the Michelson interferometer. The shorter-wavelength light source produces a proportionally greater fringe shift in the interference pattern and thus thinner films can be measured with a greater accuracy. This method is used satisfactorily for films of the range 150-600 Å.

104

535.42

Spectroscopic examination of the diffraction of light by a thin metallic half-plane. ANANTHANARAYANAN, N. *Proc. Indian Acad. Sci. A*, 14, pp. 85-92, July, 1941.—A spectroscopic examination of the Fresnel diffraction due to thin silver films bounded by a

sharp edge reveals interesting changes in the visibility and disposition of the bands in the spectrum. The visibility of the fringes is found to follow closely the spectral distribution of intensity of the transmitted light. At places where the intensity is sufficiently low the first fringe ceases to be the best, the second fringe showing max. visibility. The fringes show a sudden bend with a point of inflection in the region of selective transmission at $3\,200\text{ \AA}$, and they are shifted away from the edge on the ultra-violet side and towards the edge on the visible side. Using the Drude formula for the amplitude of the transmitted light and experimental values for μ and $k\mu$ for silver, both the intensity and phase curves have been drawn for 2 films of thicknesses $5 \times 10^{-6}\text{ cm.}$ and 10^{-5} cm. , respectively. The phase curves clearly explain the peculiar disposition of the bands at $3\,250\text{ \AA}$. A. H.

See Abstr. 195 535.42 : 548 : 539.23

105 535.434

Scattering of light by pigment particles. CLEWELL, D. H. *J. Opt. Soc. Amer.*, 31, pp. 521-527, Aug., 1941.—A formula is derived for the scattering coefficient of suspensions of particles applicable for a wide range of particle sizes and refractive indices. The formula reduces to Rayleigh's results for very small particles and for large particles of small relative refractive index, while for very large particles it gives the correct result for scattering by regular reflection. The main object, however, is to cover the intermediate region where normal diffraction plays the principal rôle. The formula is not derived rigorously but is built up in such a way that the main features of diffraction scattering are exhibited. The fact that, for any pigment, max. scattering in visible light is obtained with particles of diameter about $\lambda/2$ is accounted for, and the possibility of greater scattering of long than of short waves for particles between 0.3 and $0.5\text{ }\mu$ is predicted. Experimental evidence supporting the formula in a qualitative way is reviewed.

W. S. S.

106 535.434

Penetration of fog by light from sodium and tungsten lamps. LUCKIESH, M., AND HOLLADAY, L. L. *J. Opt. Soc. Amer.*, 31, pp. 528-530, Aug., 1941.—The authors set up sodium and tungsten light sources of equal candle power and brightness and viewed them at a distance of 1 000 ft. across a wooded ravine. Their relative visibilities were determined, with a Luckiesh-Moss visibility meter, at various hrs. of the day and night and in various weather conditions. The two kinds of light source gave about the same readings on the meter, and the authors conclude that the advantage of yellow light in foggy and misty atmospheres is greatly overrated.

W. S. S.

107 535.434

Absorption of light and heat radiation by small spherical particles. I. Absorption of light by carbon

particles. RUEDY, R. *Canad. J. Res. A*, 19, pp. 117-125, Oct., 1941.—From Mie's classical theory of the action of small spherical particles on plane waves of light the expression giving the loss of light due to absorption and scattering is reduced to the formula involving only Bessel functions of orders given by half integral values. The result is used for calculating the absorption by small carbon particles whose diameter is comparable with the wavelength of the incident light, particles that can be measured only by interference methods. When the diameter is less than $0.2\text{ }\mu$ the coefficient of absorption decreases toward the red end of the spectrum. The reverse is true for 0.3 and $0.4\text{ }\mu$ particles.

108

535.546

The polarization of luminescence of ruby. THOSAR, B. V. *Phys. Rev.*, 60, p. 616, Oct. 15, 1941.—[See Abstr. 4090 (1938)].

109

535.557 : 532.771 : 532.1

Double refraction of flow studies with methyl methacrylate polymers in solution. ROSSET, A. J. DE. *J. Chem. Phys.*, 9, pp. 766-774, Oct., 1941.—An apparatus for the measurement of double refraction of flow is described. The magnitude of birefringence, expressed as the rotation of the plane of polarized light, may be measured to 0.05° under the best conditions with the assembly. The vertical angle and double refraction of flow of dioxane solutions of a series of fractionated polymers of α -methyl methacrylate have been measured at 25° over a concentration range of from 1 g./l. to 50 g./l., depending upon the polymer under investigation. The specific birefringence, referred to the viscosity of the solvent, is a constant characteristic of each polymer in sufficiently dilute dioxane solutions. With the possible exception of behaviour in such dilute solutions, the vertical angle is dependent upon concentration. Values of the rotary diffusion const. are calculated for each polymer from measurements of the vertical angle taken in dilute solutions. The lengths of the polymers are calculated from the rotary diffusion constants. The shape and structure of the polymers are discussed from the point of view of their electrostatic and steric properties as evidenced by a molecular model. Tentative values of mol. wt. and of length/width ratio are assigned. The viscosity of dilute dioxane solutions of the polymers has been measured at 25° . The specific viscosity increment at infinite dilution is estimated by extrapolation. This quantity is a linear function of $(\text{length/width})^2$, in partial confirmation of several theories of the viscosity of macromolecular solutions.

110

535.566.2

Optically active α -bromopropionitrile. BERRY, K. L., AND STURTEVANT, J. M. *J. Amer. Chem. Soc.*, 63, pp. 2679-2680, Oct., 1941.—Optically active α -bromopropionitrile has been prepared; its refractive

and rotatory dispersion in the visible spectrum and its near ultra-violet absorption have been determined.

111 535.6

Colour measurement. PERRY, J. W. *Nature*, Lond., 148, pp. 691-692, Dec. 6, 1941.

112 535.733.1

Photographic evidence on the visibility of colour patterns in butterflies to the human and insect eyes. BRUES, C. T. *Proc. Amer. Acad. Arts Sci.*, 74, 8, pp. 281-285, 1941.—The visual range of insects generally extends much farther into the ultra-violet than in the case of the human eye, but reaches only to a wavelength of about 5900 Å at the red end of the spectrum. The paper describes experiments designed to illustrate, by means of photography, the difference in the visual pattern of a butterfly as seen by the human eye and by the eye of another butterfly or other insect. Four photographs of a number of butterflies were taken, one in Kodachrome, one with orthochromatic film when the butterfly is illuminated only by ultra-violet radiation, one with panchromatic film and ultra-violet illumination but with a filter interposed in front of the camera to cut out the ultra-violet and record only the fluorescence, and the fourth with blue and ultra-violet illumination. Photographs are shown and discussed and it appears that certain red and orange markings are readily visible to insects on account of the ultra-violet that they reflect and not by reason of the reflected orange or red that affects the human eye. W. D. W.

See Abstr. 283 535.8

* 113 535.81 : 535.34

An investigation into the variation with temperature of the spectral transmission of glasses. I. The transmission in the visual spectral region at temperatures from 20° to the softening point. HOLLAND, A. J., AND TURNER, W. E. S. *J. Soc. Glass Technol.*, 25, pp. 164-220(T), June, 1941.—Determinations of transmission in the visual spectral region are made at temperatures from 20°C. to near the approx. softening temperature in the case of 27 glasses. The determinations are made for rising and falling temperatures, the original measurements being finally rechecked to ensure absence of permanent change on heating. The range of wavelength is from 4400 Å to 7200 Å, measurements being carried out at each intermediate 100 Å interval. Tests show that the whole of the light incident on the specimens can be accounted for in the experiments and, in particular, it is demonstrated that no change in the loss by reflection with rise or fall of temperature takes place, other than that dependent on the variation with temperature of the refractive index of the glass. As a general rule, reduction in the transmission and a shift of the max. transmission towards the long-wavelength end of the spectrum occurs progressively with rise of temperature. This is uniformly the case

with colourless and only faintly coloured glass, although the effect of temperature rise affects the transmission of such glasses differently at different wavelengths, particularly at the extreme ends of the visual spectrum. The least effect is observed for the colourless standard glasses. Some interesting results are obtained for coloured glasses. A. H.

HEAT

114 536.2.08

Heat transfer to hydrogen-nitrogen mixtures in tubes. COLBURN, A. P., AND COGHLAN, C. A. *Trans. Amer. Soc. Mech. Engrs*, 63, pp. 561-566, Oct., 1941.—This paper gives results of experiments in which data were determined on heat transfer to air, to nitrogen, and to 8 mixtures of H and N, ranging from 8.85 to 98% H, flowing inside a steam-jacketed tube, 0.5 in. inside dia. and 48.75 in. long. The data were correlated when plotted as $(h/C_p G)(C_p \mu/k)^{2/3}$ v. DG/μ , with the value of $C_p \mu/k$ ranging from 0.45 to 0.73. The data checked heat-transfer data of Nusselt and showed deviation from friction analogies.

115 536.212

The conduction of heat in a medium generating heat. PATERSON, S. *Phil. Mag.*, 32, pp. 384-392, Nov., 1941.—Solutions are derived for the temperature distributions obtained under various boundary conditions in both infinite and semi-infinite media, which are conducting heat as solids of constant thermometric conductivity, and where heat is at the same time being generated or absorbed at a rate which is a linear function of the temperature. These conditions approximate to those met in certain problems of chemical physics. R. W. P.

116 536.213.3

Conditions of service with particular reference to the temperature gradient through the [furnace]-roof. DODD, A. E. *J. Iron Steel Inst.*, pp. 16-28, 1941. *Advance copy*.—Describes the temperature records obtained for the roof of an open hearth furnace [Abstr. 121 (1942)] under service conditions covering a considerable period. Cu.ves obtained during the warming-up period show that when the furnace is first gassed cool air is actually drawn through the roof. The cooling is of short duration and is followed by a rapid rise in temperature. The α - β cristobalite inversion causes large movements in the brickwork in the region of 200° to 300°C. During a normal week-end shut-down the furnace does not cool down to this dangerous region. Roof temperature fluctuations during a single melt are discussed. On tapping the hot-face falls 300° to 400°C. and during the charging period sudden fluctuations of 200 deg. are common. Fluctuations of about 50 deg. in the surface pyrometer reading observed on reversing the furnace are not considered to be due to flame

effects (as suggested by Sosman) as the thermocouple readings are also affected. From changes in the gradient through the roof with time of operation it is concluded that the thermal conductivity has increased in a zone immediately behind the working face. A change in slope at 1470°C. indicates that grey cristobalite has a higher thermal conductivity than the black tridymite which occurs below 1470°C.

R. W. P.

117

536.252

The ladle cooling of liquid steel. LAND, T. J. *Iron Steel Inst.*, [12 pp.], 1941. *Advance copy.*—An experiment using medicinal paraffin at 60°C. serves to illustrate the nature of the convection currents set up in liquid steel after tapping. Fluid flows from the surface down the walls and gradually settles as a cool layer at the bottom of the beaker. Calculations are made of the amount of heat extracted by the ladle refractories in steel tapping. Where the ladle is preheated, the preheating period should bear a definite relation to the time taken to tap and cast. Results of these calculations are tabulated to give the drop in temperature for different sizes of ladle and different times of tapping and casting, and also for the corrections to be applied for different methods of casting and for the time the metal is held in the ladle between tapping and casting. In making these calculations constant values are assumed for the various physical properties involved. Most doubt attaches to the thermal conductivity of liquid steel. Temperature measurements are to be made in the launder and casting streams by means of the quick-immersion thermocouple.

R. W. P.

See Abstr. 17, 18

536.33 : 523.8.03

118

536.41

The thermal expansion of pure metals: copper, gold, aluminium, nickel and iron. NIX, F. C., AND MACNAIR, D. *Phys. Rev.*, 60, pp. 597-605, Oct. 15, 1941.—Extremely accurate determinations of the linear thermal expansions have been made interferometrically from -196°C. to temperatures about +400°C. for Al and +700°C. for Fe, Ni, Cu and Au. The relationship between true thermal coefficient of expansion and temperature conforms well to the Grueneisen-Debye theory, when values are chosen for the Debye characteristic temperatures which agree with those chosen to achieve agreement with the Debye theory of sp. hts. The magnetic Curie temperature for Ni is found to be 352°C.

See Abstr. 34

536.42

119

536.51

Thermometric time lag. BECK, R. *Trans. Amer. Soc. Mech. Engrs.* 63, pp. 531-538; *Disc.*, 539-543, Aug., 1941.—Discusses the time lags of various types of thermometers when immersed in different media, and suggests the following as a simple method for its determination and one which can be incor-

porated in thermometer specifications: The time lag is the time taken for a thermometer immersed in a bath at a different temperature, T_b , to change from a reading T_1 to T_2 , where $T_2 = T_b - (T_b - T_1)/e$. The precautions to be taken are mentioned. In Discussion it is pointed out that the method is based on a law which only holds for an ideally simple thermometer bulb, whereas in practice secondary lags occur. The problem may be treated on the basis of an analogous electrical circuit, and formulae are given expressing the time lag in terms of the physical constants of the bulb and sheath.

R. W. P.

120

536.51 : 541.8 = 3

On precision measurement of the freezing point of non-aqueous solutions. LANGE, J. *Z. phys. Chem. A*, 186, pp. 291-298, June, 1940.—An illustrated description of apparatus and methods for determining the f.p. of aqueous and non-aqueous solutions with an accuracy within $\pm 0.0001^\circ$. A differential method is applied, in which special attention is given to heat insulation, contact between thermometer and solution, heat capacity of the thermometer and symmetry of the arrangement. A short calculation shows how the deviation of the osmotic coefficient from Debye-Hückel's law may be determined.

R. N.

121

536.532

The furnace and pyrometer installation. DOYLE, J. E., COLLINS, W. J., AND PLUCK, J. E. *J. Iron Steel Inst.*, pp. 10-15, 1941. *Advance copy.*—The 80-ton basic open-hearth furnace used in this investigation was of normal construction, and had a roof 34.5 ft. long by 17 ft. wide by 1 ft. thick composed of silica bricks. In order to measure the temperature gradient in the roof special blocks were built-in having holes $\frac{1}{2}$ in. dia. passing from the outside to within various distances ($\frac{1}{2}$, 3, 6 and 9 in.) of the inner face. These holes were for the accommodation of Pt-PtRh(13%) and chromel-alumel thermocouples which could be connected to a 6-point pyrometer for continuous recording. A radiation pyrometer sighting through a hole in the wall served to measure the temperature of the internal surface of the roof. This pyrometer consisted of a thermocouple mounted in a water-cooled tube at the focus of an air-cooled lens. It was connected to a recorder having a range from 900° to 1800°C. on a scale 10 in. wide, automatic cold-junction compensation, automatic hourly current standardization, potentiometric control, a continuous chart and an electrically driven clock. The response time was 2.18 sec.

R. W. P.

122

536.6

The heat capacity, heats of fusion and vaporization, vapour pressure and entropy of arsenic trifluoride. RUSSELL, JR., H., RUNDLE, R. E., AND YOST, D. M. *J. Amer. Chem. Soc.*, 63, pp. 2825-2828, Oct., 1941.

See Abstr. 283

536.6

See Abstr. 175

536.62 : 539.16.08

123

A new method for determining the specific heat of gases and vapours. BENNEWITZ, K., AND SCHULZE, O. *Z. phys. Chem. A*, 186, pp. 299-313, June, 1940.—An illustrated description of apparatus for measuring the sp. ht. of gases and vapours in continuous flow, between 20° and 300°C. at about atmospheric pressure. As the regulation of the thermic balance of the outfit requires several hrs., means are provided for the successive measurements of different gases. The temperature gradient of the gas flowing between the low and high temperature level is maintained constant by electric heating, and a thermocouple arrangement ensures adiabatic conditions. The result of a series of measurements on air are tabulated.

R. N.

124

A modified heat-conduction calorimeter. ZIEGLER, W. T., AND MESSER, C. E. *J. Amer. Chem. Soc.*, 63, pp. 2694-2700, Oct., 1941.—A modified heat-conduction calorimeter suitable for the study of the thermal properties of substances exhibiting transitions of the λ type is described. The heat capacities of KClO_3 , NH_4Cl and $(\text{NH}_4)_2\text{SO}_4$ have been redetermined in the temperature range 107°-320°K., using KCl as a standard substance. The entropy of NH_4Cl at 298.1°K. has been calculated.

125

The heat capacities of some cobalt hexammine halides. ZIEGLER, W. T. *J. Amer. Chem. Soc.*, 63, pp. 2700-2703, Oct., 1941.—The heat capacities of cobaltous and cobaltic hexammine iodide and cobaltic hexammine chloride have been measured with an accuracy of 1.5-2% throughout the range 107-320°K. by means of a calibrated heat-conduction calorimeter, using KCl as a standard substance. The cobaltic hexammine iodide was found to exhibit an anomalous heat capacity in the region 270-290°K., with a max. at $277.4 \pm 0.5^\circ\text{K}$. Evidence is adduced which indicates that the origin of the thermal effect is to be associated with the thermal motion of the NH_3 molecules about their Co-N bonds.

126

Rotation of groups in ionic lattices. The heat capacities of sodium and potassium cyanides. MESSER, C. E., AND ZIEGLER, W. T. *J. Amer. Chem. Soc.*, 63, pp. 2703-2708, Oct., 1941.—The heat capacities of Na and K cyanides have been measured from 100° to 345°K. by means of a calibrated heat-conduction calorimeter. Na cyanide was found to exhibit 2 regions of anomalous heat capacity with max. at $172.1^\circ \pm 0.5^\circ\text{deg. K.}$ and $288.5^\circ \pm 0.3^\circ\text{deg. K.}$, respectively. For K cyanide 1 such region was found with a max. at $168.3^\circ \pm 0.4^\circ\text{deg. K.}$ The heats of these transitions have been estimated. Certain anomalies were found in the behaviour of Na cyanide in the vicinity of its upper transition which may be

536.62 = 3

associated with non-equilibrium phenomena. That portion of the heat capacity due to the rotation of the cyanide ion was estimated for both salts. These calculations indicate that there is partially restricted rotation of the cyanide ions in the cubic modifications of both salts, and that the hindrance to rotation diminishes only gradually with increasing temperature. They indicate highly restricted rotation in the low-temperature modification of Na cyanide in the temperature region between the two transitions.

127

The specific heats at low temperatures of ferrous silicate, manganous silicate and zirconium silicate. KELLEY, K. K. *J. Amer. Chem. Soc.*, 63, pp. 2750-2752, Oct., 1941.

536.631

128

Heats of solution and reaction in anhydrous liquid ammonia. VI. SCHMIDT, F. C., SOTTYSIAK, J., TAJKOWSKI, E., AND DENISON, W. A. *J. Amer. Chem. Soc.*, 63, pp. 2669-2670, Oct., 1941.—The molar heats of solution of NH_4I and NaI have been measured over a wide range of concentration and found to have a negative heat of dilution. Heats of solution of NaNO_3 and NaCl , as well as those of a few alcohols, are reported.

536.653

129

The heats of solution of monatomic ions in methyl alcohol. ELEY, D. D., AND PEPPER, D. C. *Trans. Faraday Soc.*, 37, pp. 581-587, Nov., 1941.—The energies of solution of univalent ions in methyl alcohol have been successfully accounted for by a similar simple model of the ionic solution as was used previously for aqueous solutions. In this model 4 alcohol molecules are assumed to be held in the first co-ordination shell of the ion, and their interaction energy with the ion is obtained by evaluating the electrostatic ion-dipole energy. Outside this first shell the solvent is considered to behave as a perfect dielectric and its energy is calculated by the Born-Bjerrum equation. A simple explanation of the entropies of solution in methyl alcohol, as compared with water, by a parallel method to the above has failed. A tentative suggestion has been made that the first shell of oriented dipoles can impose a similar orientation over a shell of solvent several molecules thick.

536.653

130

Heats of combustion and of formation of the nine isomeric heptanes in the liquid state. DAVIES, G. F., AND GILBERT, E. C. *J. Amer. Chem. Soc.*, 63, pp. 2730-2732, Oct., 1941.—Isothermal heats of combustion at 25° are reported for the 9 isomeric heptanes. From these are calculated the energies of isomerization for the heptanes in liquid form. The heats of formation at 25° are calculated and tabulated.

536.66

- See Abstr. 231. 536.7 : 541.132
 See Abstr. 240. 536.7 : 541.135.5
 See Abstr. 280. 536.7 : 541.8
 See Abstr. 49. 536.73 : 532.613.4
 131. 536.74

The temperature concept from the macroscopic point of view. BALAMUTH, L., WOLFE, H. C., AND ZEMANSKY, M. W. *Amer. J. Phys.*, 9, pp. 199-203, Aug., 1941.—The authors seek to bridge the gap between the simple conception of temperature as the degree of hotness or coldness of a body and the formal treatment of Carathéodory [*Math. Ann.*, 67, 355, 1909]. An isotherm is first deduced as being the locus of all points representing states in which a system is in thermal equilibrium with one state of another system, and temperature is deduced as that property which determines whether or not a system is in thermal equilibrium with other systems. The scalar character of temperature is established on the basis of the zero'th law of thermodynamics—2 systems in thermal equilibrium with a 3rd are in thermal equilibrium with each other—and there follows the derivation of the accepted scales of temperature.

R. W. P.

- See Abstr. 124. 536.75 : 536.62

ELECTRICITY

132. 537.122 : 535.23

Finite self-energies in radiation theory. II. LANDÉ, A., AND THOMAS, L. H. *Phys. Rev.*, 60, pp. 514-523, Oct. 1, 1941.—The method proposed [Abstr. 2066 (1941)] is equivalent to a field theory based on Maxwell's equations supplemented by Yukawa's equations, both fields having the same point charges as sources. The chief result is a finite self-energy $W = e^2/2r_0$ and a modified Coulomb potential $(e/r)[1 - \exp(-r/r_0)]$, also derivable from a Hamiltonian in Fourier form. For accelerated motions the field theory yields a finite force of inertia $(-m\ddot{x})$ together with the universal damping term in first approximation. Small additional terms reflect the structure of the electron. Radiation and self-force of a vibrating electron are discussed, and the perturbation problem is formulated. The exact integration of Yukawa's field equation is given. Results are related to Born-Infeld's unitary field theory and Dirac's theory of the classical electron, in particular with respect to waves of velocity larger than c . The electronic mass m is the result of photons of rest mass zero and mesons of rest mass $M = m \cdot 2 \cdot 137 = 274m$.

- See Abstr. 274. 537.226.1 : 541.67 : 621.315.616.96

133. 537.226.33 : 539.389.3 : 621.3.048.81

Elastic after-effects and dielectric absorption in glass. TAYLOR, N. W. *J. Appl. Phys.*, 12, pp. 753-758, Oct., 1941.—Similarities between the mathematical expressions for elastic and electrical polarization effects in glasses are discussed, and are cited

as evidence in support of the concept that there are several sizes of complex silicate ions in glass, and that these various ionic units respond independently and with different rates to applied stress. This theory is in harmony with other physico-chemical evidence and the X-ray evidence of random ionic networks.

A. M. T.

134. 537.228.1 : 621.396.611.21

Contour-mode vibrations in Y-cut quartz crystal plates. BUILDER, G., AND BENSON, J. E. *A.W.A. Techn. Rev. [Amal. Wireless Aust.]*, 5, 5, pp. 181-189, 1941.—[Abstr. 1296 B (1941) and 159 B (1942)].

- See Abstr. 254. 537.241 : 541.18 = 3

135. 537.36

Ion exchange between solids and solutions. WALTON, H. F. *J. Franklin Inst.*, 232, pp. 305-337, Oct., 1941.—A general review covering the following aspects: materials showing ion exchange as exemplified by minerals, synthetic inorganic ion exchangers, and ion exchange in organic compounds and in colloidal particles; distribution of ions between cation exchangers and solutions, covering equivalence of exchange and anion adsorption, the existence of a single solid phase, the distribution equation, ions of different valencies, effect of dilution and temperature, distribution constants of different cations, and the effect of swelling and of anions in solution; technical applications of ion exchange with reference to water softening, efficiency of a softening cycle, total removal of electrolytes from water, special applications in water treatment, ion exchange applications outside water treatment, and materials made from ion exchangers. The report ends with a detailed bibliography of original papers.

N. M. B.

- See Abstr. 256. 537.363 : 541.182.6

136. 537.525.6

Positive column plasma in a strong longitudinal magnetic field. REICHRUDEL, E., AND SPIWAK, G. *J. Phys.*, U.S.S.R., 4, 3, pp. 211-226, 1941.—The effect of a longitudinal magnetic field on the positive column plasma is investigated at low pressure (10^{-3} to 1 mm. Hg) in mercury vapour or argon. By means of 2 experimental methods (that of a plane probe and of a concentrically divided anode) the influence of the magnetic field on the distribution of a directed electron current and the radial concentration of electrons in the discharge tube were examined. From these probe measurements data were obtained concerning plasma contraction in the uniform magnetic field. The peculiarities of probe characteristics for strong magnetic fields are discussed. Parallel measurements carried out with an anode made up of concentric rings are in good agreement with results of the probe measurements.

137. 537.525.9

Theory of the anode fall in glow discharges. ENGEL, A. VON. *Phil. Mag.*, 32, pp. 417-426, Nov., 1941.—

Theory is presented relative to the anode fall in glow discharges when a positive column is present. An attempt is made to find the factors that govern the dependence of the anode fall on the current between the electrodes. The positive column is assumed to fill the tube except for the wall-sheath, to be uniform so that the longitudinal electric field is constant, and to be free from oscillations and striations. The gas is supposed to have no electron affinity, so that the conductivity is due exclusively to the motion of positive ions and electrons. Secondary processes are also neglected. The formulae derived for the anode fall, the thickness of the anode zone and its dependence on pressure and current density, are compared with experimental results and discussed. A. W.

138

537.531 : 535.3

A remnant effect in X-ray reflection from quartz due to a strong electric field. I. KAKIUCHI, Y. *Proc. Phys.-Math. Soc. Japan*, 23, pp. 637-645, Aug., 1941.—The intensity of X-ray reflection from quartz crystals, subjected to a strong electric field for a long time, is measured after the removal of the field and found to be several times larger than the normal reflection. This remnant effect in the increase of reflection gradually disappears and the decay is accelerated by the irradiation of γ - or X-rays or by heating the crystal at a high temperature. It is concluded that the effect is due to the mosaic structure of the crystal, temporarily amplified by the application of a strong field. An interpretation of the phenomena is suggested.

139

537.531 : 535.3

X-ray diffuse reflections from sodium and lithium in relation to elastic anisotropy. LONSDALE, K., AND SMITH, H. *Nature, Lond.*, 148, pp. 628-629, Nov. 22, 1941.—The diffuse X-ray reflections from a number of single crystals of Li and of Na have been photographed at various temperatures. Both show beautiful and elaborate patterns of spots and streaks, which are temperature-sensitive but not structure-sensitive. The diffuse-spot detail observed for the {110}, {002}, {112}, {130}, {222} planes of Na, using filtered or unfiltered radiation from a Cu target, is found to be that predicted by Jahn [*Nature*, 147, 511 (1941)]. The diffuse-spot detail for Li is very similar to that of Na, and it follows therefore, from X-ray observations alone, that the elastic constants are roughly of the same order of magnitude and anisotropy for the two metals. All the evidence points to a simple, body-centred cubic, 2-atom unit cell of Laue symmetry $m\bar{3}m$ for Li, as correctly assumed by previous investigators.

H. H. HO.

140

537.531 : 535.338

The L-radiation from sulphur. TOMBOULIAN, D. H., AND CADY, W. M. *Phys. Rev.*, 60, pp. 551-553, Oct. 15, 1941.—The L-emission band from a S target has been studied spectrophotometrically, and

the intensity contour of the band has been deduced. The essential features consist of a strong peak at 149 eV, less pronounced structures at about 158 eV, and a broad peak or tail around 136 eV, in agreement with previous studies. In contrast with the corresponding bands from the metallic elements of the second row of the periodic table, the drop in intensity on the high-energy side of the band occurs gradually. Because of this fact, and perhaps also because of insufficient resolving power, the L_{II} and L_{III} edges have not been separated. A tentative interpretation has been given for the main observed features. No trace of the L_I - L_{III} transition has been found.

141

537.531 : 535.4

Temperature study of X-ray diffraction by diamond. LONSDALE, K., AND SMITH, H. *Phys. Rev.*, 60, pp. 617-618, Oct. 15, 1941.

See Abstr. 291

537.531 : 548 : 535.3

142

537.531.8 : 621.383.2

The X-ray photon efficiency of a multiplier tube. ALLEN, J. S. *Rev. Sci. Instrum.*, 12, pp. 484-488, Oct., 1941.—The design and operation of a 12-stage electrostatic multiplier tube as a photon counter are discussed. The tube has a pure Ta photo-electric surface, the multiplying electrodes being covered with oxidized Be. With 300 V between successive electrodes the tube has a background counting rate of about 3 to 5 pulses/min. and records about 1 photon in 500 at a wavelength of 10^{-8} cm. The multiplication is about 18 000.

143

537.531.9

Ejection of photo-electrons by X-rays near the angle of total reflection. GORNEY, N. B. *J. Phys., U.S.S.R.*, 4, 3, pp. 247-258, 1941.—The behaviour of the reflection coefficient of X-rays and of photo-electric emission from 2 mirrors (lacquer film on a silver backing and a silver mirror) at angles close to the limiting angle of total reflection is investigated. Experimental curves are given from which it follows that the angle at which the max. of photo-electric emission sets in does not correspond to the limiting angle of reflection. It is shown that the photo-electric max. corresponds to the angle at which the depth of penetration of the X-rays becomes equal to the depth from which photo-electrons can emerge. From the point of view under consideration an interpretation is given of the curves obtained by Ehrenberg and Jentszsch.

144

537.533

Temperature dependence of the periodic deviations from the Schottky line. GUTH, E., AND MULLIN, C. J. *Phys. Rev.*, 60, p. 535, Oct. 1, 1941.

145

537.533.74

Nuclear scattering of electrons in thin metallic films. I. PETUKHOV, V. A., AND VYSHINSKY, I. A. *J. Phys., U.S.S.R.*, 4, 3, pp. 235-246, 1941.—The scattering of electrons of 40-120 keV energy in Al films

$5 \cdot 10^{-6}$ – $2 \cdot 10^{-5}$ cm. thick in an angle interval of 119.5° to 122° is investigated. A method of longitudinal focusing by a homogeneous magnetic field is employed, which permits the energy distribution of the scattered electrons to be obtained. It is shown that the nuclear scattering is elastic, i.e. without energy loss, and that the effective scattering cross-section is in accordance with Mott's theory.

146

537.533.74

The scattering of fast electrons in argon. BRAILOVSKY, V. P., AND LEIPUNSKY, A. I. *J. Phys., U.S.S.R.*, 4, 6, pp. 485–491, 1941. The nuclear scattering of electrons of 1.5–3 eMV energy in an angle interval of 20° to 180° is studied, using a cloud chamber filled with argon. Results agree with Mott's theory.

147

537.533.74

A determination of the atomic field of bromine from electron scattering. FRYE, W. E. *Phys. Rev.*, 60, pp. 586–588, Oct. 15, 1941.—The experimental curves for the scattering of electrons by bromine have been analysed to determine the phase shifts as functions of the energy. The method of phase shift analysis is described in detail. The atomic field of Br is calculated from the phase shifts by a method involving the WKB approx. to the phase shifts.

See Abstr. 32

537.533.74 : 531.717

148

537.533.75

An investigation of the radiation losses of electrons by the calorimetric method. IVANOV, A. V., WALTER, A. K., SINELNIKOV, K. D., TARANOV, A. J., AND ABRAMOVICH, A. M. *J. Phys., U.S.S.R.*, 4, 4, pp. 319–334, 1941.—Measurements were carried out by means of an electron beam accelerated by an electrostatic aggregate and oscillating under the influence of an alternating magnetic field. The oscillating beam entered 2 vacuum calorimeters successively, of which one was lined with Li, the other with Pb. The difference in the temperature of the calorimeters was measured, as well as the absolute value of the heat developed in one of them. Correcting for the thermal effect, due to the partial absorption of the radiation by the walls of the calorimeters, the data make it possible to determine the difference in the radiation losses in Li and Pb for different energies of the electrons in the beam. The experimental data agree with calculations according to the theory of Bethe and Heitler. The conclusion is drawn that, when fast electrons pass through Pb, no processes connected with the transformation of the kinetic energy of the electrons into the energy of particles weakly absorbed by Pb take place, apart from the ordinary radiation losses accounted for by theory.

149

537.533.75

Absorption coefficient of β -rays. TCHENG DA-TCHANG AND YANG JENG-TSONG. *Phys. Rev.*, 60, pp. 616–617, Oct. 15, 1941.

150

537.534.8

On the scattering of mesons by nuclear particles. TANIKAWA, Y., AND YUKAWA, H. *Proc. Phys.-Math. Soc. Japan*, 23, pp. 445–454, June, 1941.—There is a discrepancy between the theoretical and experimental cross-sections of scattering of mesons by nuclear particles. An attempt is made to discover whether this can be removed by assuming the existence of the pseudo-scalar meson, as well as the vector meson. It is shown that this discrepancy cannot be explained without making another *ad hoc* assumption. The capture of pseudo-scalar mesons by atomic nuclei, and the creation of meson pairs by a photon, are also considered.

A. J. M.

151

537.591.1

On the protonic nature of the primary cosmic radiation. COCCONI, G. *Phys. Rev.*, 60, pp. 532–533, Oct. 1, 1941.

152

537.591.1

Positive excess in mesotron spectrum. BERNARDINI, G., WICK, G. C., CONVERSI, M., AND PANCINI, E. *Phys. Rev.*, 60, pp. 535–536, Oct. 1, 1941.

153

537.591.1=3

Are there neutral mesotrons in cosmic rays? NISHINA, Y., AND BIRUS, K. *Sci. Pap. Inst. Phys. and Chem. Res., Tokyo*, No. 1029, pp. 360–370, June, 1941.—The existence of neutral mesotrons would be expected from Yukawa's theory, but no transformation of charged into neutral mesotrons has been shown, since the results of other investigators [Abstr. 152 (1942)] are inconclusive and admit of an alternative explanation. There is no experimental proof of the existence of neutral mesotrons. It is probable that they have an exceedingly short range ($\sim 3 \times 10^{-6}$ cm.) and a very short life ($\sim 10^{-16}$ sec.).

A. J. M.

154

537.591.1 : 539.185.9 = 3

Transformation effect of neutral mesotrons. NISHINA, Y., BIRUS, K., SEKIDO, Y., AND MIYAZAKI, Y. *Sci. Pap. Inst. Phys. and Chem. Res., Tokyo*, No. 1028, pp. 353–359, June, 1941.—A neutral mesotron, if it has sufficient energy, may be expected to give a charged and a neutral particle on collision with a neutron or proton. Thus a certain number of the charged mesotrons which enter a counter tube placed over an absorber must be neutral when they have passed through the latter, and will then have no effect on a counter tube placed below the absorber. Experiment shows that this is actually the case, 2.5% of the total number of particles penetrating 3 m. of iron being neutral. This result can, however, be explained also by the scattering of mesotrons, or the production of secondary particles in the absorber. [See Abstr. 153 (1942)].

A. J. M.

155

537.591.15

Cloud-chamber investigation of penetrating showers.

JÁNOSY, L., McCUSKER, C. B., AND ROCHESTER, G. D. - *Nature Lond.*, 148, p. 660, Nov. 29, 1941.

156 537.591.15(85)

A mesotron shower. WOLLAN, E. O. *Phys. Rev.*, 60, p. 532, Oct. 1, 1941.—A report on cloud-chamber records at S. Cristobal.

157 537.591.15 : 539.164.83

On the presence of strongly ionizing particles in cosmic-ray showers. COCCONI, G. *Phys. Rev.*, 60, p. 533, Oct. 1, 1941.

158 537.591.2

The energy spectrum of the primary cosmic rays. HU CHIEN SHAN. *Phys. Rev.*, 60, p. 614, Oct. 15, 1941.

159 537.591.5

Mesotron variation with upper air temperatures. HESS, V. F., AND BENEDETTO, F. A. *Phys. Rev.*, 60, pp. 610-611, Oct. 15, 1941.

160 537.591.5

Latitude effect and the decay of mesotrons. YOUNG, JR., R. T. *Phys. Rev.*, 60, pp. 614-615, Oct. 15, 1941.

161 537.591.8

On the theory of secondary showers. LANDAU, L. *J. Phys.*, U.S.S.R., 4, 4, pp. 375-376, 1941.

MAGNETISM. ELECTROMAGNETISM

162 538.221

High permeability and superstructure in Fe-Si-Al alloys "Sendust" type. SELISKY, I. P. *J. Phys.*, U.S.S.R., 4, 6, pp. 567-568, 1941.—It is shown that the increase in permeability is stimulated by partial disordering due to rapid cooling. Superstructures of Fe₃Si and Fe₃Al are present in both binary systems Fe-Si and Fe-Al. In ternary alloys a similar superstructure, Fe₃(Al, Si), is probably formed.

163 538.221

On the cause of high permeability of alloys Fe-Si-Al ("Sendust"). ZAIMOVSKY, A. S., AND SELISKY, I. P. *J. Phys.*, U.S.S.R., 4, 6, pp. 563-565, 1941.—It is shown that the high permeability of the Fe-Si-Al system is closely connected with very small values of magnetostriction and the magnetic anisotropy constant, and thus the theory of Fe-Ni-permalloy may be extended to cover the Fe-Si-Al alloys.

See Abstr. 292 538.221 : 548

164 538.27

On the temperature dependence of magnetic permeability in weak fields. ZAIMOVSKY, A. S. *J. Phys.*, U.S.S.R., 4, 6, pp. 569-572, 1941.—Permeability/temperature curves are plotted for Si-steel, 3 Fe-Ni alloys, Mo-permalloy, mumetal, pure Ni and 40 Fe-Si-Al alloys. The anomalous temperature dependence of permeability in Fe-Si-Al alloys is established, indicating an anomaly in the constitution of ternary solid solutions of these alloys.

See Abstr. 260 538.615 : 541.182.63 : 535.34

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165

538.632

The arrangement of atoms in the alloy AuCu₃ and the Hall coefficient. KOMAR, A., AND SIDOROV, S. *J. Phys.*, U.S.S.R., 4, 6, pp. 552-554, 1941.

See Abstr. 30 538.652 : 531.7

166 538.752 (744)

A new laboratory for cosmic-terrestrial research. STETSON, H. T. *Terr. Magn. Atmos. Elect.*, 46, pp. 313-318, Sept., 1941.

MOLECULAR AND ATOMIC PHYSICS

167 539.133

Determination of dipole moment in solution. DAVAR, D. J., AND PARANJPE, G. R. *Indian J. Phys.*, 15, pp. 173-183, June, 1941.—The apparent electric moment of ortho-, meta- and para-nitrotoluene is measured in each of the solvents hexane, heptane, carbon tetrachloride, benzene, toluene, carbon disulphide and chloroform. The results are used to verify the empirical relations of Müller, Sugden and Jenkins, and the theories of Frank and Higasi, which connect the measured value of the electric moment with the value in the gaseous state. It is found that (1) the Sugden relation $P_2 = A + B(\epsilon - 1)/(\epsilon + 2)$ can be used for determining polarization at infinite dilution; (2) the empirical relation $\propto P_2 = \alpha/\sqrt{\epsilon(\text{solvent})}$ represents the results as well as the relations of Sugden and Jenkins; (3) the idea of extrapolation to $\epsilon = 1$ for the gaseous state needs reconsideration since the values obtained from the relations of Sugden, Jenkins, Frank and the authors are widely different; (4) if a critical dielectric constant, which requires extrapolation to $\epsilon = 1.7$ for the gaseous state, is introduced as a hypothesis, there appears a general agreement between the values so derived from the relations of Sugden, Jenkins, Frank and the authors.

168 539.133

The internuclear distance in the fluorine molecule. ROGERS, M. T., SCHOMAKER, V., AND STEVENSON, D. P. *J. Amer. Chem. Soc.*, 63, pp. 2610-2611, Oct., 1941.

169 539.133

The molecular properties of lignin solutions. LOUGHBOROUGH, D. L., AND STAMM, A. J. *J. Phys. Chem.*, 45, pp. 1137-1138, Oct., 1941.

See Abstr. 45 539.133 : 532.612.4

170 539.152.1 : 541.144

Introduction to the theory of nuclear reactions. MORRISON, P. *Amer. J. Phys.*, 9, pp. 135-162, June, 1941.—A review of the theory of nuclear reactions is given. It is developed along the lines of the model of the nucleus, the course of nuclear reactions, and some typical nuclear reactions. Some special processes, including deuteron bombardment, photo-disintegration and nuclear fission, are also dealt with.

A. J. M.

See Abstr. 94

539.153 : 535.338

171

539.153 : 535.343.3

Correlation of energy levels of linear and bent triatomic molecules, and the ultra-violet CS₂ absorption spectrum. MULLIKEN, R. S. *Phys. Rev.*, 60, pp. 506-513, Oct. 1, 1941.—A set of vibronic levels for a $^1\Sigma_g^+$ and a $^1\Pi_g$ electronic state of linear AB₂ is shown in a diagram, together with gyroibronic levels of the corresponding electronic states (a $^1A_1$ and a $^1B_2$ and a $^1A_2$) of bent AB₂; and a correlation is set up between the sets of gyroibronic levels of the 2 cases. This diagram is then used in a discussion of the near-ultra-violet absorption bands of CS₂, where the molecule is linear in the $^1\Sigma_g^+$ ground state. The band types and structures for such a transition are discussed; the structures should be practically identical in character, whether the upper state is linear or bent. Vibrational intensities, and their relation to a strong allowed electronic transition at shorter wavelengths, are also discussed. It is concluded that the near-ultra-violet system is an electronic-allowed transition to a $^1B_2$ bent-molecule upper state related to a $^1\Pi_g$ linear-molecule state.

See Abstr. 97

539.153 : 535.343.3

172

539.154

On the term energies for f^3 configuration. AMEMIYA, A. *Proc. Phys.-Math. Soc. Japan*, 23, pp. 664-665, Aug., 1941.

173

539.16.08

The half-life of iodine (128). HULL, D. E., AND SEELIG, H. *Phys. Rev.*, 60, pp. 553-555, Oct. 15, 1941.—The half-life of I (128) has been measured with high accuracy by means of a G-M counter and amplifying circuit of tested reliability. An absolute calibration of the counter was carried out by a simple method. The half-life was determined from the data by an arithmetical method. The results of 4 closely concordant experiments give for the best value of the half-life, $T = 24.99 \pm 0.02$ min. It is suggested that this radio-element can now be used in a quick and convenient calibration of counters or other instruments for measurement of radioactivity.

174

539.16.08

Absolute sensitivity of Geiger counters. CRAGGS, J. D. *Nature, Lond.*, 148, p. 661, Nov. 29, 1941.

175

539.16.08 : 536.62

A microcalorimetric determination of the mean energy of β -rays from radium E. ZLOTOWSKI, I. *Phys. Rev.*, 60, pp. 483-488, Oct. 1, 1941.—A very precise microcalorimetric method of determining the mean energy of RaE β -rays is described. The method involves an adiabatic change of temperature of a small calorimeter whose heat capacity is measured by determining the change in temperature produced by several strong sources of polonium. With the aid of Curie's absolute apparatus the abs. value of the polonium content in these sources as well as in the RaE samples

after the decay of the parent substance could be determined with an accuracy of from 1 to 2%. The average value of the β -ray mean energy of RaE deduced from these experiments is $320\,000 \pm 5\,000$ eV. The measurements made in air gave a mean energy of 323.6 ± 3.5 ekV, or slightly higher than those carried out in N (317.6 ± 2.5 ekV). The most probable value is nearer the lower limit.

176

539.162

On the classical model of nuclear fission. PLESSET, M. S. *Amer. J. Phys.*, 9, pp. 1-10, Feb., 1941.—Parts of the classical theory of fission developed by Bohr and Wheeler are described. The potential energy of deformation and the kinetic energy of oscillation are considered in a manner similar to that used by Rayleigh on the oscillation of water droplets in a jet.

A. J. M.

177

539.162

Meson lifetime and radioactive β -decay. ROZENTAL, S. *Phys. Rev.*, 60, pp. 612-613, Oct. 15, 1941.

178

539.163 = 3

Radioactive investigations of solutions and powders. LIESEBERG, C. *Z. phys. Chem. B*, 47, pp. 269-287, Oct., 1940.—The reduction in emanation yield of radioactive solutions by the addition of sulphates or carbonates, and especially with and without the additional presence of Ba or Ca salts, is investigated. The intensity of this reduction depends on the ability of the Ra sulphate or carbonate to form mixed crystals with the added salts. Ba salts and Ra sulphate, both belonging to the rhombic system, are liable to mix in crystallizing, and the addition of Ba for lengthening the life of radioactive solutions should therefore be avoided. No emanation was adsorbed by the precipitate formed in these tests. The author examines the adsorption of emanation on powders of phosphors and their basic materials, e.g. unannealed and annealed ZnS, CaS with or without additional Cu or Bi. The addition of these metals appears to cause a structural change of the basic materials as the adsorption is considerably reduced.

R. N.

179

539.163

Radioactive bromine isotopes from uranium fission. MOUSSA, A., AND GOLDSTEIN, L. *Phys. Rev.*, 60, pp. 534-535, Oct. 1, 1941.

180

539.163.1

A note on the radiochemistry of europium. FAJANS, K., AND VOIGT, A. F. *Phys. Rev.*, 60, pp. 533-534, Oct. 1, 1941.

181

539.163.2

A study of the disintegrations of ^{38}Cl , ^{28}Al , and ^{24}Na with the use of the method of coincidence counting. WATASE, Y. *Proc. Phys.-Math. Soc. Japan*, 23, pp. 618-632, Aug., 1941.—The γ - γ and β - γ coincidences of ^{38}Cl , ^{28}Al and ^{24}Na were investigated. ^{38}Cl : The predictions from the Fermi plots were

confirmed, the existence of the 2.8 eV group of β -rays being definitely shown. Of the 3 groups of β -rays, whose energies are 4.99, 2.80 and 1.16 eV, the 2.80 eV group accompanies a γ quantum of 2.19 and the 1.16 group 2 successive γ quanta of 2.19 and 1.64 eV, the latter being emitted at first.
²⁸Al: The β - γ coincidence remains constant throughout the whole range of the β -rays. There is no γ - γ coincidence. ²⁴Na: In this case the β - γ coincidence remains const. throughout the whole range of the β -rays; but appreciable γ - γ coincidence was observed showing that 2 quanta are successively emitted after each β disintegration. The angular correlation of the successive quanta was investigated at 90° and 180° of the angle subtended by the 2 counters. In the case of ²⁴Na the rate of coincidence showed no change with the angle, while in the case of ³⁸Cl the value at 90° was definitely larger than the one at 180°.

182

539.164.8

Extension of the radioactive series, $Z = N \pm 1$.
 ELLIOTT, D. R., and KING, L. D. P. *Phys. Rev.*, 60, pp. 489-496, Oct. 1, 1941.—The radioactive positron emitters ^{Si}²⁷, ^S³¹ and ^A³⁵ were produced by 15 eMV α -particles while ^{Sc}⁴¹ was obtained by 8 eMV deuterons. The half-lives of these elements have been determined as 4.92 ± 0.1 sec., 3.18 ± 0.04 sec., 1.88 ± 0.04 sec., and 0.87 ± 0.03 sec., respectively. The upper limit of the energies of the positrons emitted by ^S³¹, ^A³⁵ and ^{Sc}⁴¹, were measured and found to be 3.87 ± 0.15 eMV, 4.41 ± 0.09 eMV, and 4.94 ± 0.07 eMV, respectively. The Coulomb energies of the extra proton of the nuclei of the $Z - N = 1$ were calculated according to 2 nuclear models. The variations in the Coulomb energies indicate a nuclear shell structure similar to that given by the Hartree model of the nucleus.

See Abstr. 157

539.164.83 : 537.591.15

See Abstr. 75

539.164.9 : 535.215

183

539.166.2

γ -rays emitted from ²⁴Na, ²⁷Mg, ²⁸Al and ³⁸Cl.
 ITOH, J. *Proc. Phys.-Math. Soc. Japan*, 23, pp. 605-617, Aug., 1941.—The energy of the γ -rays was determined by analysing secondary electrons with a magnetic spectrometer. The errors are about 1%. Level schemes of product nuclei are deduced in the cases of ²⁴Na, ²⁸Al and ³⁸Cl in connection with β -ray transformations.

184

539.166.83

The recoil electron spectrum of γ -rays from thorium active deposit. LATYSHEV, G. D., and KULCHITSKY, L. A. *J. Phys., U.S.S.R.*, 4, 6, pp. 515-521, 1941.—The recoil electron spectrum of γ -rays from a Th active deposit is investigated, and the relative intensities of the γ -lines are determined. The theory of internal conversion with the formation of pairs is verified. The multipolarity of hard γ -lines is deter-

mined. A nuclear level system for ThC' is suggested. The ratio of the probability of radiation of a γ -quantum to that of emission of a long-range α -particle from an excited level (1800 ekV) in the ThC' nucleus is determined.

185

539.167.3

Radioactive isotopes of barium from caesium.
 CORK, J. M., and SMITH, G. P. *Phys. Rev.*, 60, pp. 480-482, Oct. 1, 1941.—Radioactive isotopes of Ba of half-lives 40.0 hrs. and 340 hrs. are made by bombarding Cs with deuterons of 9.5 eMV energy. The former is shown by absorption measurements and by the magnetic β -spectrometer to consist of a partially converted γ -ray of energy 276.4 ekV. The latter activity is associated with K-electron capture in Ba¹³³ and consists solely of a 17 ekV γ -ray and the K X-radiation of Cs of energy about 30 ekV. The 40.0 hr. activity is probably due also to a highly excited state of Ba¹³³, although the existence of an excited state of the stable Ba¹³⁴ would equally well satisfy the data. The probability of total conversion for the 40.0 hr. γ -ray is about 71%, and the ratio of the K and L components is found to be 3.18. From the calculations of Hebb and Nelson this indicates a change in angular momentum of 4 units.

186

539.172

Photo-fission of uranium and thorium produced by the γ -rays of lithium and fluorine bombarded with high-speed protons. ARAKATSU, B., UEMURA, Y., SONODA, M., SHIMIZU, S., KIMURA, K., and MURAOKA, K. *Proc. Phys.-Math. Soc. Japan*, 23, pp. 440-445, June, 1941.—Fission cross-sections of U and Th nuclei for different γ -ray quanta have been determined as follows: $\sigma_{U(17)} = 16.7 \times 10^{-27}$ cm.² for Li(p, γ)- γ -rays; $\sigma_{Th(17)} = 7.2 \times 10^{-27}$ cm.² for Li(p, γ)- γ -rays; $\sigma_{U(6.3)} = 2.2 \times 10^{-27}$ cm.² for F(p, γ)- γ -rays; $\sigma_{U(2.2)} \ll 0.005 \times 10^{-27}$ cm.² for RaC γ -rays. The experimental method is described.

A. J. M.

187

539.172.4

Production and isotopic assignment of long-lived radioactive sulphur. KAMEN, M. D. *Phys. Rev.*, 60, pp. 537-541, Oct. 15, 1941.—Thick-target yields for the 3 important nuclear processes giving rise to the long-lived radioactive S isotope are reported. The cross-sections calculated from yield values favour the assignment of the activity to S³⁵. The upper limit for the negative electrons emitted by active S is found by absorption measurements in Al and cellophane to be 120 ± 15 ekV. The half-life is 88 ± 3 days. It is concluded that neutron irradiation of CCl₄ affords the most efficient means whereby samples of radioactive S adequate for tracer work may be obtained. The chemical extraction of the S is described and the application of the procedure to large-scale production found feasible. Preliminary investigations on the chemistry of the recoil S produced in the nuclear

reactions are reported. It is observed that resonance neutrons (absorbed by Cd) are effective in producing S by the (n, p) process analogous to the $N^{14}(n, p)C^{14}$ reaction.

188 539.172.4

A study of the radiations from the disintegration of Br^{82} . ROBERTS, A., DOWNING, R., AND DEUTSCH, M. *Phys. Rev.*, 60, pp. 544-550, Oct. 15, 1941.—The radiations from the 36 hr. activity ascribed to Br^{82} have been studied by coincidence methods, absorption and spectrometer techniques. The β -ray spectrum is simple, and its endpoint is at 0.465 ± 0.01 eMV. Each β -ray is accompanied by 3 cascade γ -rays of energies 0.547 ± 0.01 , 0.787 ± 0.015 , and 1.35 ± 0.03 eMV. Neither orbital electron capture to Se^{82} nor internal conversion of the γ -rays is observed. Coincidence measurements made on the β -ray spectrometer yield independent confirmatory evidence of the simplicity of the β -ray spectrum. Some considerations concerning the excited states of Kr^{82} obtained in this disintegration are presented.

189 539.172.4

Transmutation of mercury by fast neutrons. SHERR, R., BAINBRIDGE, K. T., AND ANDERSON, H. H. *Phys. Rev.*, 60, pp. 473-479, Oct. 1, 1941.—The products of the transmutation of Hg by fast $(Li + D)$ neutrons were investigated. Three radioactive Au isotopes were found to be formed by the $n-p$ reactions: 65 hr. Au^{198} , 78 hr. Au^{199} , and a new unassigned electron emitter with a period of 48 min. Three radioactive Pt isotopes were observed and attributed to $n-\alpha$ reactions in Hg: 29 min. Pt^{199} , 19 hr. Pt^{197} , and a new activity with an 80 min. half-life. The latter period was also observed in deuteron and fast-neutron bombardment of Pt, but was not found in slow-neutron irradiation of Pt. Radioactive Hg isotopes with 43 min., 25 hr., and 50-day periods, were observed in the fast-neutron irradiation of Hg. The 43 min. and 26 hr. activities were also formed by bombarding Pt with γ -particles. Difficulties in the assignment of the 80 min. Pt and the 43 min. and 25 hr. Hg activities are discussed.

190 539.172.4

Protons from deuteron bombardment of C^{13} . HUMPHREYS, R. F., AND WATSON, W. W. *Phys. Rev.*, 60, pp. 542-544, Oct. 15, 1941.—Comparison of the proton groups emitted under deuteron bombardment by a target of ordinary C and by one enriched 25 times in C^{13} shows the existence of an excited state of C^{14} at 5.24 ± 0.29 eMV. This state serves as a possible source for the known 5.5 eMV γ -rays. There is no evidence of any lower-lying excited level in the C^{14} nucleus.

See Abstr. 154 539.185.9 : 537.591.1 = 3

191 539.211

Image of finely machined technical surfaces in the supermicroscope. BORRIES, B. VON, AND JANZEN, S.

Z. Ver. dtsch. Ing., 85, pp. 207-211, March 1, 1941.—With a grazing electron beam the surface of a 2 mm. dia. piece of steel was investigated, in its original state and after hardening, and in 3 states of surface treatment, viz. roughly ground, finely ground, and polished. The supermicroscope pictures were taken with the axis of the test piece (1) in the meridional plane of the beam axis, and (2) perpendicular to this plane. The pictures are compared with those taken with an ordinary microscope. The resolving power of the supermicroscope is nearly $\frac{1}{10}$ of that of the optical microscope. With a series of pictures quantitative values for the coarseness of surfaces of different grades of machining may be obtained. R. N.

192 539.215.4 : 621.357.7

Structure and grain size of electro-deposited copper. BUTTS, A., AND NORA, V. DE. *Trans. Electrochem. Soc.*, 79, pp. 163-184; *Disc.*, 184-185, 1941.—[Abstr. 116 B (1942)].

193 539.216

The formation of fibres from non-fibrous native proteins. LUNDREN, H. P. *J. Amer. Chem. Soc.*, 63, pp. 2854-2855, Oct., 1941.

194 539.217.3 : 535.34

Spectroscopic studies of base exchange materials. BUSWELL, A. M., AND DUDENBOSTEL, B. F. *J. Amer. Chem. Soc.*, 63, pp. 2554-2558, Oct., 1941.—Experimental determination of the absorption of water by various clays.

195 539.23 : 548 : 535.42

Electron diffraction studies of thin films. II. Anomalous powder patterns produced by small crystals. GERMER, L. H., AND WHITE, A. H. *Phys. Rev.*, 60, pp. 447-454, Sept. 15, 1941.—In electron diffraction patterns produced by very small face-centred cubic crystals the (200) ring shows abnormally weak intensity [Abstr. 3160 (1939)]. This was studied by microphotometer curves for crystals of estimated mean linear dimensions 20 Å to 67 Å in Cu films. The ratio of intensities of the (200) and (111) rings varied from 0.14 for the 20 Å to 0.42 for the 67 Å crystals, the latter figure agreeing with the theoretical value 0.48 for large Cu crystals. Calculations are made to determine the scattering from gas molecules, assuming for each molecule N similar atoms with a face-centred cubic arrangement. For $N = 55$ no (200) ring can be detected, while for $N = 379$ the (200) ring is very plain and all the rings have relative intensities appropriate to large crystals. The anomaly is thus accounted for on the basis of smallness of the individual crystals. N. M. B.

196 539.23 : 621.357.65

Formation of anodic coatings on aluminium. EDWARDS, J. D., AND KELLER, F. *Trans. Electrochem. Soc.*, 79, pp. 135-142; *Disc.*, 143-144, 1941.—[Abstr. 115 B (1942)].

197

The microstructure of used roof bricks. HUGILL, W. *J. Iron Steel Inst.*, pp. 48-55, 1941. *Advance copy*.—When used bricks from the roof of an open-hearth furnace are examined, 10 zones of different colour can be distinguished. Microscopic examination of sections from a number of zones has been carried out, and the crystalline nature of each is discussed. Three main factors contribute to the production of zones: the temperature gradient through the brick, the ingress of inorganic oxides as dust or vapour into the hot surface of the brick, and the passage of gaseous products of combustion through the brick. These are fully discussed.

A. J. M.

198

The results of X-ray studies of the raw material and of used silica bricks from the open-hearth furnace roof. JAY, A. H. *J. Iron Steel Inst.*, pp. 45-47, 1941. *Advance copy*.—The nature of the raw material from the open-hearth furnace roof has been investigated by the back-reflection X-ray method, and the changes after firing have been examined. The smaller the particles of ground samples, the greater is the conversion into tridymite. In lump rock the degree of conversion into quartz at the centre of the lump is relatively high, and the amount of tridymite formed is small. In the case of used silica bricks from the furnace roof the constitution and crystalline development was determined in 6 different zones.

A. J. M.

199

Presentation of the concept of liquid structure. THOMAS, C. D., AND GINGRICH, N. S. *Amer. J. Phys.*, 9, pp. 10-13, Feb., 1941.—The atomic distribution curve obtained by X-ray diffraction studies of liquids is the most quantitative expression of structure that can be given. The method of arriving at the atomic distribution curve is described.

A. J. M.

200

An X-ray study of the structure of polyvinyl alcohol. MOONEY, R. C. L. *J. Amer. Chem. Soc.*, 63, pp. 2828-2832, Oct., 1941.—The structure of polyvinyl alcohol has been determined from a study of its X-ray fibre diagram. The experimental data consist of photographs taken with Cu radiation filtered through Ni. The reflections, about 30 in number, were indexed with reference to a pseudo-orthorhombic cell of the following dimensions: $a = 7.82$, $b = 2.52$, $c = 4.60$ Å. The structure consists of long-chain molecules so oriented that pairs of chains are linked through hydroxyl bonds.

201

An X-ray study of the structure of rectifying selenium films. CLARK, G. L., AND ROACH, P. G. *Trans. Electrochem. Soc.*, 79, pp. 355-365; *Disc.*, 365-366, 1941.—[Abstr. 37 B (1942)].

202

On Guest's law of elastic failure. SETH, B. R.

539.24

Proc. Indian Acad. Sci. A, 14, pp. 37-40, July, 1941.—The author shows that the theory of finite strain developed in recent papers [Abstr. 3452 (1936)] gives a criterion of failure similar to that of Guest [Abstr. 2128 (1900)], namely that, besides the shearing stress, volumetric stress should also be taken into account.

G. E. A.

203

A derivation of the equations of equilibrium of a thin plate. JEFFREYS, H. *Phil. Mag.*, 32, pp. 365-368, Nov., 1941.—The mathematical treatment of thin plates for this purpose is much shortened by using the principle of virtual work and tensor notation.

G. E. A.

539.26

204

Rigidity modulus of beta-brass single crystals. GOOD, W. A. *Phys. Rev.*, 60, pp. 605-609, Oct. 15, 1941.—The rigidity modulus of 10 β -brass single crystals has been measured as a function of crystal orientation and of temperature from 25° to 500°C. by the method of the composite piezo-electric oscillator. The reciprocal of the rigidity modulus is linearly related to the orientation function. When these data are combined with previous measurements of Young's modulus [Abstr. 700 (1941)], the principal elastic parameters are found to be 3.88, -1.52 and 0.578×10^{-12} cm.²/dyne, respectively, at room temperature. Curves and tables give them as functions of temperature up to and slightly beyond the critical temperature for order-disorder.

539.32

205

Elastic-plastic deformation of mechanically strained solids. HOLZMÜLLER, W., AND JANCKEL, E. *Z. phys. Chem. A*, 186, pp. 359-372, June, 1940.—By applying Maxwell's equation for the mechanical behaviour of an elastic-viscous substance to a finite number of section elements into which the unit section is subdivided, each element having its own relaxation time, a system of linear differential equations is derived and solved under the assumption of a constant stress. Thus the deformation, and the elastic after-effect and resilience when the stress is removed, are calculated. For the case of 2- and 3-section elements these quantities and their dependence on time and on the elastic constants are given. Conversely it is shown how the values of relaxation times, section elements and elastic constants, may be computed from experimental curves.

R. N.

206

Migration in crystal lattices. BARRER, R. M. *Trans. Faraday Soc.*, 37, pp. 590-599, Nov., 1941.—Four mechanisms of diffusion through crystal lattices are recognized—zeolitic (where there are channels in the lattice of sufficient width to permit of the passage of ions or molecules), place exchange, migration of holes (Schottky disorder), and migration of interstitial ions (Frenkel disorder). Equations are given for the

539.378.3

539.26 : 621.314.634

diffusion constants for these mechanisms, and some properties of the diffusion constants are considered. Metal-metal diffusion, the diffusion of salt-pairs, and self-diffusion are discussed. In an alloy AB, zeolitic diffusion of A is likely when the ratio of atomic radii A : B is less than 0.59. Where the radius of A is comparable with that of B, diffusion should be of Schottky defects, or by place exchange. In salt-pairs it is usually of Frenkel or Schottky defects. For self-diffusion the Schottky or place exchange mechanisms must apply. Large values of D_0 in the diffusion equation $D = D_0 e^{-E/RT}$ are characteristic of Schottky disorder, and such values are obtained in practice for self-diffusion.

A. J. M.

207

539.382.2

A stress/strain curve for the atomic lattice of aluminium. WOOD, W. A., AND SMITH, S. L. *J. Inst. Met.*, 67, pp. 315-324, Oct., 1941.—A stress/strain curve has been obtained for the atomic lattice of Al subjected to tensile stress. This curve gives the displacement of the atoms from their normal positions on a selected set of atomic planes and the nature of their recovery when the external stress is removed. The planes chosen are those with spacing practically perpendicular to the applied tensile stress, which should contract in conformity with the external contraction of the cross-section of the tensile test-piece as the specimen is stretched. It is shown that, up to the external yield point, the contraction in lattice spacing is directly proportional to the applied stress. Beyond the yield stress the lattice contraction slows down and the spacing rapidly reaches a limiting value. At stresses approaching the ultimate the lattice actually tends to expand. A further set of experiments, in which cycles of stress were employed, shows that, when a stress greater than the yield is employed, the contracted lattice spacing, instead of expanding back to its original value, passes through that figure and reaches a permanent value in excess of the original. The lattice is left with a permanent expansion which increases in a regular manner with the value of the stress applied; a process which explains the unexpected shape of the lattice stress/strain curve and reveals the presence of a fundamental factor, hitherto unobserved, in the mechanical deformation of metals.

208

539.384.2

Flexure of continuous beams and beams with fixed ends. EGAN, A. L. *Engineering*, 152, pp. 341-342, Oct. 31, 1941.—In place of the textbook methods of integration or consideration of free bending moments to find the net bending moments and deflections of beams, the author gives a simpler method based on the fact that an analysis of the slopes at the supports provides a simple and logical solution. An analysis is given which covers all cases of continuous beams of 2 spans and is also applicable to single spans.

Calculation of the free slopes and the reactions at the supports is discussed, and a new method is given for calculating the deflections along a continuous beam.

G. E. A.

209

539.384.4

High-tensile steel in design. THOMAS, E. W. *Engineering*, 152, p. 342, Oct. 31, 1941.—The use of high-tensile steel-alloys tends to a reduction in thickness of structural members, and conditions are created, favourable to the incidence of elastic instability. It is shown that the instability may, in addition, be torsional in nature. A graph indicates that, as the proof stress of the steel increases, so also does the tendency to instability. Recognition of this liability is of importance with the increasing use of high-strength alloy sheet and strip.

G. E. A.

See Abstr. 133 539.389.3:537.226.33:621.3.048.81

210

539.4

A high-temperature bolting material. WHEELER, A. W. *Trans. Amer. Soc. Mech. Engrs*, 63, pp. 655-662; *Disc.*, 663-668, Oct., 1941.—This paper reviews a series of tests on heat treatment, creep, rupture and hardness, together with the application of the results to bolting-material practice.

211

539.4.016.3 : 621.365.52.029.45

Surface hardening by induction. OSBORN, JR., H. B. *Trans. Electrochem. Soc.*, 79, pp. 215-241; *Disc.*, 61-70, 1941.—[See Abstr. 1111 B (1941) and 122 B (1942)].

212

539.434

The creep recovery of a 0.17% carbon steel. JOHNSON, A. E. *Proc. Instn Mech. Engrs*, 145, pp. 210-220, Oct., 1941.—The paper investigates the relation between recovery and the stress, temperature, period of test, and strain, in the creep test preceding the recovery, and presents data by means of which the existing theories are compared. Creep and recovery tests were made in creep units capable of measuring creep rates of the order 10^{-8} in./in./hr., the test temperature being maintained constant to ± 0.5 deg. C. At each of the temperatures 425°, 455° and 485°C. groups of creep tests—continued to periods of 0.2, 2, 20, and 145 hrs., respectively—were made, each group consisting of tests at 3 different stresses. Each test piece on unloading was allowed to recover for 100 hrs. One or two similar tests were also made at 350° and 550°C. In addition, at 425°, 455° and 485°C., groups of creep tests were made, and were carried to the stage of min. creep rate; the test piece was then unloaded and allowed to complete its recovery. These groups of tests also consisted of tests at 2 or 3 stresses. The author discusses the relation of creep recovery to stress, temperature, period of creep and strain in the initial creep test, and finally tabulates principal conclusions which apply only to the steel tested and

are not to be taken as generally true for other materials. A bibliography is included.

213

539.51

The forgeability of metals. ELLIS, O. W. *Engng J., Can.*, 24, pp. 466-475, Oct., 1941.—A recapitulation of experimental work on forgeability of metals with reference to properties of materials, technique required and results obtained, in die-forging and in free-forging. The author refers to methods necessary for the forging of light alloys as well as steel and copper, and concludes with an example in detail of an eccentric cam produced in steel and in Al alloy of medium forgeability with an estimate of comparative cost of manufacture.

214

539.536

Surface hardness of metals. CHALMERS, B. *J. Inst. Met.*, 67, pp. 295-314, Oct., 1941.—Details are given of a method for measuring the hardness of thin surface layers of metals and other materials, in which the reduction in optical reflectivity is determined when known quantities of sand are allowed to impinge on the surface under standardized conditions. Applications of this technique are described in cases where other methods of measuring hardness are unsatisfactory, and some indications are given of the possibility of applying the method to investigations on the properties of surface films.

215

539.557

The planoflex: a simple device for evaluating the pliability of fabrics. DREBY, E. C. *J. Res. Nat. Bur. Stand., Wash.*, 27, pp. 469-477, Nov., 1941.—The planoflex, a simple device for measuring the extent to which a fabric can be distorted in its own plane without producing wrinkles on its surface, was developed to evaluate the pliability of woven fabrics. Results of measurements on a series of cotton percales show an 88% correlation with their tactual pliability ratings. The planoflex may be used for testing all woven fabrics except those that are heavily starched.

216

539.621 : 621.89

Studies in lubrication. X. Friction phenomena and the stick-slip process. MORGAN, F., MUSKAT, M., AND REED, D. W. *J. Appl. Phys.*, 12, pp. 743-752, Oct., 1941.—The friction apparatus consists essentially of a table, which can be made to rotate at a very low velocity, and a slider, elastically supported at the centre of rotation of the moving surface. Examples are shown of the stick-slip process with several combinations of metals at various speeds and loads. Motion pictures of the slider and table have been made in order to study possible slipping during the stick phase. Temperature records of the stick-slip cycle indicate that the temperature flash is confined exclusively to the slip period and in no case exceeds 50° C. above ambient. Traces made of the slip phase with very high camera speeds permit an analysis of the variation of kinetic friction with velo-

city. Thus both static and kinetic friction data can be obtained from a single stick-slip cycle. [Abstr. 345 (1941)].

PHYSICAL CHEMISTRY

See Abstr. 281, 282

541.12 : 541.8

217

541.123.23

Phase equilibria in the 2-component system, ethylene-propylene, in the critical-temperature region. SCHNEIDER, W. G., AND MAASS, O. *Canad. J. Res. B*, 19, pp. 231-240, Oct., 1941.—Phase equilibria measurements have been made for a 1:1 ethylene-propylene system in the critical-temperature region by means of an equilibrium apparatus described by Holder and Maass. The critical density of the system was found to be 0.230 g./cm.³ and the critical temperature 58.30° ± 0.05°C. For mass/volume ratios greater than 0.230, at const. volume, the temperature of liquid disappearance was lower than 58.30°C., while for mass/volume ratios less than 0.230 the temperature of liquid disappearance was higher than 58.30°C. With stirring the phase compositions and phase densities of the liquid and vapour phases were shown to become equal at the critical temperature, whereas in the absence of stirring the attainment of equilibrium is slow and uncertain. The results are discussed on the basis of the liquid persistence theory, and the vapour-liquid dispersion theory.

218

541.123.4

Thermodynamic properties of binary solid solutions on the basis of the nearest-neighbour approximation. LASSETTRE, E. N., AND HOWE, J. P. *J. Chem. Phys.*, 9, pp. 747-754, Oct., 1941.—An approx. method of computing the partition function of a binary solid solution is formulated. If the only constraints are on the mean energy and mean composition, it is shown that no metastable phase is predicted. The partition function is shown to be obtainable from the largest eigenvalue of a quadratic form and the condition for a phase transition is shown to be related to the degeneracy of the largest eigenvalue. The physical interpretation of the eigenfunction is shown to be related to the probability of surface configuration, while the square of the eigenfunction is related to the probability of a configuration on the interior of the crystal. Some simple examples are discussed which are related to the effect of co-ordination number on phase transitions.

219

541.124

Some kinetic considerations of the thermal decomposition of benzenediazonium chloride in various solvents. WARING, C. E., AND ABRAMS, J. R. *J. Amer. Chem. Soc.*, 63, pp. 2757-2762, Oct., 1941.

220

541.124

Dielectric and solvent effects upon the alkaline fading of brom phenol blue. AMIS, E. S., AND COOK, S. E. *J. Amer. Chem. Soc.*, 63, pp. 2621-2625,

Oct., 1941.—The reaction between the negative divalent brom phenol blue ion and the negative univalent hydroxide ion was studied in iso-composition and iso-dielectric glycerol-water media over the temperature range 10–60°. The energies of activation measured in glycerol-water media were opposite in trend to the predictions of electrostatic theory and were attributed to an equilibrated reaction between NaOH and glycerol. The measured rates corrected for dielectric effects were proportional to the mole fraction of glycerol at the higher concentrations of this component of the binary solvent. At lower concentrations of glycerol, however, k is no longer proportional to the mole fraction of this substance and rapidly approaches the water point. This sharp break in the trend was attributed to the hydrolysis of the compound formed between glycerol and NaOH at lower concentrations of glycerol.

221 541.124

The exchange reaction between gaseous and combined nitrogen. JORIS, G. G. *J. Chem. Phys.*, 9, p. 775, Oct., 1941.

222 541.124.7

Kinetic studies in ester hydrolysis. I. The hydrolysis of halogeno-aliphatic esters. II. The influence of solvent on the reaction. ANANTAKRISHNAN, S. V., AND KRISHNAMURTI, S. *Proc. Indian Acad. Sci. A*, 14, pp. 270–288, Sept., 1941.—The kinetics of acid hydrolysis of some aliphatic esters have been studied at 4 different temperatures in 60% dioxan. The effect of the halogen on the parameters of the Arrhenius equation are discussed from the standpoint of the electronic theory of organic reactions. Both viscosity and dielectric constant influence the reaction, and a close correlation of the parameters of the reaction-velocity equation is noticed.

223 541.124.7

The coupling action of the Grignard reagent. VII. Di- α -methyl benzyl chlorides. FUSON, R. C., DENTON, J. J., AND KNEISLEY, J. W. *J. Amer. Chem. Soc.*, 63, pp. 2652–2653, Oct., 1941.

224 541.124.7.036

The thermal decomposition of methyl- n -butyl ether. MAGRAM, S. J., AND TAYLOR, H. A. *J. Chem. Phys.*, 9, pp. 755–761, Oct., 1941.—The thermal decomposition of methyl- n -butyl ether proceeds in a manner analogous to that of the other ethers. There is no evidence to support the suggestion that it might decompose into methyl alcohol and ethylene by a ring closure through a hydrogen bond. In the first stages of the decomposition about 60% of the ether decomposes into CH_4 and $\text{C}_3\text{H}_7\text{CHO}$ and about 40% into HCHO , C_2H_4 and C_2H_6 . The decomposition of the aldehydes occurs at rates greater than that of the ether, probably induced by radicals from the ether. The butyraldehyde yields mainly CH_4 , C_2H_4 and CO . First-order constants fall off as the reaction

proceeds and also with diminishing pressure. The energy of activation at about 200 mm. pressure is 54.0 kcal. and at 100 mm. 56.6 kcal. For the reaction inhibited by nitric oxide the energy of activation is about 60 kcal.

225

541.126

Combustion explosions in pressure vessels protected with rupture discs. CREECH, M. D. *Trans. Amer. Soc. Mech. Engrs*, 63, pp. 583–588; *Disc.*, 588, Oct., 1941.—The present experimental results indicate definitely that, by using a higher factor of safety in design of vessel, combined with a rupture disc of suitable size, every vessel containing an explosive combustible mixture can be protected. For many of the less violently explosive mixtures a rupture disc alone will give absolute protection from a destructive explosion.

H. H. HO.

226

541.127

The pyrolysis of formaldoxime. TAYLOR, H. A., AND BENDER, H. *J. Chem. Phys.*, 9, pp. 761–765, Oct., 1941.—Formaldoxime decomposes in a first-order reaction to give hydrogen cyanide and water at a rate $k = 10^{9.5} e^{-39000/RT}$ sec.⁻¹. The products react together at a slower rate to give principally CO and NH_3 although N , H , ethane and traces of unsaturate, are also produced. The reaction is probably heterogeneous on a clean glass surface. It is accelerated by traces of air and by NO . These facts offer an adequate explanation of the fate of methyl radicals in NO -inhibited reactions by the isomerization of the CH_3NO complex into formaldoxime.

227

541.128

Exchange reaction of biacetyl with deuterium oxide. WALTERS, W. D. *J. Amer. Chem. Soc.*, 63, pp. 2850–2851, Oct., 1941.

228

541.132

Electrolytic dissociation in nitric acid as studied by Raman effect. RAO, N. R. *Indian J. Phys.*, 15, pp. 185–189, June, 1941.—The absolute degree of dissociation of the acid is calculated by comparing the intensities of the Raman lines in the spectra of solutions of NaNO_3 and HNO_3 of equal molal concentrations, assuming that NaNO_3 dissociates completely even in very concentrated solutions. The results indicate that, in the lower concentrations, the increase of dissociation with dilution is very small, whereas in the concentrated solutions it is rapid. This is explained as being due to the increase in the H -ions in the lower concentrations, which therefore favour the backward reaction.

229

541.132

Transference numbers of sulphuric acid in anhydrous methanol at 25°. KANNING, E. W., AND WALTZ, J. E. *J. Amer. Chem. Soc.*, 63, pp. 2676–2678, Oct., 1941.—The activity coefficients and cation transference numbers of sulphuric acid in anhydrous methanol

were determined at 25° by the e.m.f. method over a concentration range of 0.5443 *m* to 0.01375 *m*.

230

541.132

The dissociation constant of brom cresol green in water. KILPATRICK, M. *J. Amer. Chem. Soc.*, 63, pp. 2667-2668, Oct., 1941.—The thermodynamic dissociation const. has been found to be 1.11×10^{-5} at 25°.

231

541.132 : 536.7

The ionization constant of formic acid in dioxane-water mixtures. HARNED, H. S., AND DONE, R. S. *J. Amer. Chem. Soc.*, 63, pp. 2579-2582, Oct., 1941.—From the e.m.f. of suitable cells the ionization const. of formic acid in 20, 45, 70 and 82% dioxane-water mixtures was determined from 0 to 50°. The variation of the ionization const. with temperature is expressed by the equation

$$\log K = -\frac{A}{T} + B - CT$$

where *A*, *B*, and *C* are empirical constants. Equations for the calculation of the free energy, heat content, entropy and heat capacity of the ionization process are given.

232

541.133 = 3

On the effect of water vapour on the electric conductivity of NaCl pastilles. TOMKA, P. *Z. phys. Chem. A*, 186, pp. 227-238, May, 1940.—The pastilles were prepared under different pressures and subjected to different heat treatments. Current fluctuations were observed to occur suddenly and irregularly, the deviation from normal being dependent on the pressures used in the preparation and on the temperature at which the pastilles are tempered. The effect of the H₂O molecules is only one of a larger complex of similar phenomena.

R. N.

233

541.133

The conductance of hydrochloric acid in aqueous solutions from 5° to 65°. OWEN, B. B., AND SWEETON, F. H. *J. Amer. Chem. Soc.*, 63, pp. 2811-2817, Oct., 1941.—The conductance of HCl in water was determined and tabulated at 10 deg. intervals from 5° to 65°, and at concs. between 0.001 and 15 *M*. The limiting conductance was evaluated at each temperature. A table of ionic mobilities, and their temperature-coefficients, is constructed. The temperature coeff. of the chloride ion mobility appears to increase with temperature, contrary to the behaviour of the H (and other) ions. The contribution of experimental errors to this anomaly is discussed.

234

541.134

The potentials of iron-chromium alloys containing hydrogen. UHLIG, H. H., CARR, N. E., AND SCHNEIDER, P. H. *Trans. Electrochem. Soc.*, 79, pp. 111-119; *Disc.*, 119-127, 1941.—The equilibrium potentials of Fe-Cr alloys in oxygen-free 4% NaCl solution are active between 0% and 11.5% Cr,

showing a gradual trend in a noble direction with increasing Cr concentration. At 11.5% and higher Cr concentrations the potentials are noble, characteristic of passive metals, with only slight potential change on increasing Cr to 20%. When cathodic H is diffused from a face of the alloy not in contact with the NaCl solution, the potentials all become more active by several hundredths to several tenths of a volt, the greater change being characteristic of the passive alloys. Relative passivity of the alloys containing interstitial H persists, the critical Cr conc. for passivity being at 15% instead of 11.5%. The data indicate that recently pickled iron and stainless steels are chemically active, probably because they contain dissolved hydrogen retained during pickling. The relatively long time to establish the iron or alloy equilibrium potential is presumably governed (1) by the rate at which a metal hydroxide film forms which establishes the ion concentrations, and (2) by the rate at which interstitial H comes into equilibrium with the electrolyte. The data are explained on the viewpoint supported by additional facts that interstitial H directly increases the free energy for solution of lattice atoms to ions in aqueous solution. The potential change of the cell produced by interstitial H is shown to be delayed by some mins. or hrs. after starting the cathodic H discharge, the time depending on the Cr content of the alloy. This delay is a measure of the time for H diffusion in the alloy. For pickled specimens the diffusion times are less than for unpickled specimens.

235

541.134

Irreversible electrode phenomena of thallium.

II. Cathode potential in Ti₂SO₄ solution. LEBARON, I. M., AND CHOPPIN, A. R. *Trans. Electrochem. Soc.*, 79, pp. 155-162, 1941.—The cathode potential of Tl in Ti₂SO₄ solutions of various concentrations was determined. The current densities varied from 0 to 0.01 A/cm.² The data were applied to the theoretical treatment of Agar and Bowden [Abstr. 414 (1939)], and the depth of the diffusion layer calculated. The depth was found to decrease with an increase in current density. The effect of temperature on the cathode potential was determined, and an increase in temperature was found to decrease the overvoltage of the electrode. [See Abstr. 3029 (1940)].

236

541.134

Voltammetry with stationary micro-electrodes of platinum wire. LAITINEN, H. A., AND KOLTHOFF, I. M. *J. Phys. Chem.*, 45, pp. 1061-1079, Oct., 1941.—The term voltammetry is introduced to describe the determination and interpretation of current/voltage curves in electrolysis. Current/voltage curves with definite and constant diffusion current regions are shown for the deposition of Ag, Cu, Pb and Th ions, for the reduction of ferricyanide ions, ferric ions, quinone and oxygen, and for the

oxidation of ferrocyanide ions, ferrous ions and hydroquinone. The diffusion current was found to be proportional to the concentration, usually to an accuracy of $\pm 1\%$. The proportionality between diffusion current and concentration indicates the constancy of the effective diffusion layer thickness near the micro-electrode. The diffusion current was found to be proportional to the calculated diffusion coefficients in $0.1 N$ indifferent salt solution, to an accuracy of $\pm 5\%$, indicating that the effective diffusion layer thickness is at least approx. constant for the various electrode processes. The effective diffusion layer thickness was found to depend on the total salt concentration in solution. With increasing temperature, from 20° to 30°C . the diffusion layer was found to become thinner.

237

541.134

Voltammetric determinations and amperometric titrations with a rotating micro-electrode of platinum wire. LAITINEN, H. A., AND KOLTHOFF, I. M. *J. Phys. Chem.*, 45, pp. 1079-1093, Oct., 1941.—Current/voltage curves for the reduction of O, Ag ion and Br obtained with rotating micro-electrodes, are described. The diffusion current was shown to be proportional to the concentration in a medium of constant salt concentration. The current/voltage curves in general were found to have abnormal slopes in comparison with those expected, assuming concentration polarization to be the only type of electrode polarization. Other types of electrode polarization, such as that caused by a slow electrode reaction or an abnormal activity state of freshly plated metals, are indicated by the results. The applicability of a rotating micro-electrode to the determination of small concentrations of oxygen, silver and bromine, is pointed out. The amperometric titration of very dilute solutions of arsenite with bromate and of silver with chloride is described, and the possible application to other cases is indicated.

238

541.135.1

The electrolysis of arylmagnesium bromides in ethyl ether: the behaviour of short-lived aryl free radicals. EVANS, W. V., PEARSON, R., AND BRAITHWAITE, D. *J. Amer. Chem. Soc.*, 63, pp. 2574-2576, Oct., 1941.—The products of electrolysis of phenyl-, *p*-tolyl-, *p*-chlorophenyl- and benzylmagnesium bromides are reported. The alternative discharge of aryl halides as an anode reaction is shown to occur with aromatic Grignard reagents. The behaviour of short-lived aryl free radicals in ether solution is discussed and mechanisms advanced for their reactions.

239

541.135.5

The silicon carbide electrode. HUME, D. N., AND KOLTHOFF, I. M. *J. Amer. Chem. Soc.*, 63, pp. 2805-2806, Oct., 1941.

240

541.135.5 : 536.7

The lead-amalgam/lead-fluoride electrode and

thermodynamic properties of aqueous sodium fluoride solutions. IVETT, R. W., AND VRIES, T. DE. *J. Amer. Chem. Soc.*, 63, pp. 2821-2825, Oct., 1941.—Na amalgams were used as reference electrodes in solutions of NaF to measure the potential of the Pb(Hg, 2 phase)|PbF₂|F⁻ electrode. The standard molal electrode potential was calculated for 15° , 25° and 35° from the data. The mean activity coefficients of from $0.01 m$ to saturation, and the free energy, heat and entropy, of dilution of NaF solutions are calculated.

241

541.135.6

Studies of electrochemical polarization. LORCH, A. E. *Trans. Electrochem. Soc.*, 79, pp. 129-134, 1941.—Previous work [Abstr. 1142 B (1937)] on the electrochemical polarization of the H electrode is extended. It is shown that the reaction of oxygen at the electrode is diffusion-controlled even on the weakest Pt and Ir catalysts. A detailed examination is made of the diffusion process.

242

541.135.6 = 3

On measurement of polarization capacity of mercury electrodes by the method of Erdey-Grúz and Kromrey. BONHOEFFER, K. F., AND OTTO, E. *Z. phys. Chem. A*, 186, pp. 248-252, May, 1940.—The method [see Abstr. 1455 (1932)] consists in polarizing the electrode at short intervals with impulses of constant current, alternatively as cathode and anode, and measuring the change of potential. Although the dependence of polarization capacity on voltage agrees with calculations from the electro-capillary curve, the quantitative results show considerable discrepancies. The experiments confirm that this is solely due to impurities.

R. N.

243

541.135.6

Current/voltage curves of mercurous and mercuric salts at the dropping-mercury electrode. KOLTHOFF, I. M., AND MILLER, C. S. *J. Amer. Chem. Soc.*, 63, pp. 2732-2734, Oct., 1941.—At the dropping electrode the equilibrium $\text{Hg}^{++} + \text{Hg} \rightleftharpoons \text{Hg}_2^{++}$ is attained practically instantaneously. The waves obtained with well dissociated mercuric and mercurous salts, therefore, are practically identical. HgCl_2 in contact with dropping Hg yields calomel quantitatively at the surface of the electrode. Mercurous and mercuric Hg in their salts can be determined polarographically, preferably in the presence of a max. suppressor. In $0.1 N \text{HNO}_3$ the diffusion coeff. of Hg_2^{++} was calculated to be $0.92 \times 10^{-5} \text{ cm}^2 \text{ sec}^{-1}$ and of $\text{Hg}^{++} + 0.82 \times 10^{-5} \text{ cm}^2 \text{ sec}^{-1}$ at 25° .

244

541.135.62

The effect of gas pressure on the passivity of iron. CROG, R. S., AND HUNT, H. *Trans. Electrochem. Soc.*, 79, pp. 145-152; *Disc.*, 153, 1941.—An attempt was made to determine the effect of decreased pressure on the passivity of Fe in CrO_3 solutions. Under the conditions of the experiments there was no observed

effect. The passivity or activity of the iron was measured by the potential of the Fe/CrO_3 solution half-cell with a $\text{Hg}|\text{Hg}_2\text{CrO}_4|4.0\text{ M H}_2\text{CrO}_4$ electrode as the reference half-cell. Iron was found to be active in CrO_3 solutions containing moderate concentrations of halide ions. Iron wires, when heated at red heat in a vacuum (0.01 mm. of Hg), were found to be passive in CrO_3 solutions. Hence it would seem improbable that an adsorbed film of oxygen could be the cause of the passivity. Some oxide may form when the wire is heated in a vacuum, depending upon the degree of the vacuum; however, no such oxide film should form upon heating in an atmosphere of N. Therefore, if there were no oxide film on the metal surface before heating it in N, none should form during the process and the passivity could not be due to an oxide film formed during the heating process. However, this does not preclude the possibility of the formation of such an oxide film after immersion into the chromate solution.

245

541.136.3 : 621.355.2

The voltage of the sponge lead plate during discharge of the storage battery. WILLIHNGANZ, E. *Trans. Electrochem. Soc.*, 79, pp. 243-251; *Disc.*, 251, 1941.—[Abstr. 109 B (1942)].

246

541.138 : 612.1

Diagnosis of cancer by means of the dropping-mercury electrode. KLATT, T., RUSCH, H. P., DIRKSEN, A., AND MELOCHE, V. W. *Trans. Electrochem. Soc.*, 79, pp. 413-416; *Disc.*, 416, 1941.

247

541.138.2 : 621.315.221

Formation of lead monoxide as a cable-sheath corrosion product. WOLF, E. F., AND BONILLA, C. F. *Trans. Electrochem. Soc.*, 79, pp. 307-328; *Disc.*, 328-329, 1941.—[Abstr. 48 B (1942)].

248

541.138.2 : 621.357.2.035

The efficiency of a sodium chlorate cell with rod cathodes. McLAREN, J., TURER, J., DAVIS, F. H., PITMAN, A. L., AND GROGGINS, P. H. *Trans. Electrochem. Soc.*, 79, pp. 93-109; *Disc.*, 109, 1941.—[Abstr. 114 B (1942)].

249

541.138.3

The electrolytic reduction of methyl ethyl ketone to *sec*-butyl alcohol and *n*-butane. SWANN, JR., S., BENOLIEL, R. W., LYONS, L. R., AND PAHL, W. H. *Trans. Electrochem. Soc.*, 79, pp. 83-91; *Disc.*, 91, 1941.—The electrolytic reduction of methyl ethyl ketone to *sec*-butyl alcohol and butane in acid solution has been studied at many cathodes. The most active cathodes for *sec*-butyl alcohol formation were Pb and Zn. The best yield of *sec*-butyl alcohol was obtained at a Zn cathode. The influence of the crystal structure of the cathode material is discussed.

250

541.138.3

The reduction of sulphurous acid (sulphur dioxide) at the dropping-mercury electrode. KOLTHOFF, I. M., AND MILLER, C. S. *J. Amer. Chem. Soc.*, 63, pp. 2818-

2821, Oct., 1941.— SO_2 in aqueous solutions can be determined polarographically in 0.1 to 1 *N* solutions of strong acids. The diffusion current is found proportional to the total SO_2 concentration. The diffusion coefficient in aqueous medium was calculated. Keeping the total sulphite concentration constant, the diffusion current decreases markedly when the pH becomes > 2 . At a $\text{pH} \geq 7$ no wave is found. This behaviour is attributed to the facts that sulphurous acid exists in 2 tautomeric forms, 1 of which is reducible, and that the speed of transformation of strongly acid form to the weakly acid form is relatively small. At a pH of 6 two small waves were found, the first one corresponding to a reduction to hydrosulphite, and the second to a reduction of the latter to thiosulphate.

251

541.141.11 = 3

The photochemical reaction between bromine and chloral. KLUG, H., AND SCHUMACHER, H. J. *Z. phys. Chem. B*, 47, pp. 67-92, Sept., 1940.—This reaction was investigated between 70° and 90°C.; it is a chain reaction, the principal products being CO, HBr, CCl_3Br , COBr_2 and CHCl_3 . The quantum yield is about 120 mol./hv at 90°C., a light absorption of 3.5×10^{13} hv/cm.³ and pressures of 100 mm. Hg of the chloral and Br. The temperature coeff. per 10 deg. rise is 1.57. The differences in comparison with the photochemical reaction between Cl and chloral [Abstr. 4307 (1939)] are explained. R. N.

252

541.141.12 = 3

On the influence of light on cellulose solutions. STEURER, E. *Z. phys. Chem. B*, 47, pp. 127-154, Sept., 1940.—Ultra-violet irradiation of solutions of methyl cellulose in dioxane causes a strong irreversible decrease of viscosity due to the decomposition of the long molecular chains, as measured between 2 200 and 3 600 Å. The observed absorption spectra were compared with those of non-irradiated methyl cellulose and of methyl ethers of various low-molecular sugars. It appears likely that the chain separations due to the irradiation take place at the O-bridges which may represent partly glucosidic links inside the chains and partly mesh bridges between the chains. Other properties of the irradiation products, e.g. osmotic pressure and polydispersity, were investigated and compared with those of well-known decomposition products obtained by other processes. R. N.

See Abstr. 170

541.144 : 539.152.1

253

541.147.7

Sensitometry and a developer. CLARK, D. S. *Radiography*, 7, pp. 164-173, Nov., 1941.—A standard formula of a typical photographic metol hydroquinone developing solution is given, consisting of metol, sodium sulphite, hydroquinone, sodium carbonate, potassium bromide and water. A sensitometer to determine the part played by the individual components of the solution is described and illustrated.

Visible light, rather than X-rays, was used for the investigations, since it can be more easily controlled. The effect of omission of each of the components of the solution in turn is detailed, particularly with respect to the actions of the metol and of the hydroquinone components.

B. J. L.

254 541.18 : 537.241 = 3

On the electric double layer in colloids. KRUYT, H. R., AND BRUYN, H. DE. *Z. phys. Chem. A*, 186, pp. 282-290, June, 1940.—The electrokinetic potential is determined by electrometric investigations. The method consists in measuring the activity of the ions which determine the potential and expressing the results in function of the concentration of the neutral electrolyte. The measurements were made with an AgI sol brought to flocculation in AgNO₃. The ζ -potential is shown as function of the concentration of the neutral electrolytes and of the density of the wall charge.

R. N.

255 541.182.5

Rigidity and moisture hysteresis in gels. BARKAS, W. W. *Nature, Lond.*, 148, pp. 629-630, Nov. 22, 1941.—The purpose of this note is to account for the hysteresis in a gel in terms of its elastic properties; the points in favour of the theory presented are (1) that hysteresis depends only on considerations of energy; and (2) it is accounted for in terms of those elastic properties which distinguish gels from solutions. The work done in shear will depend on restraints imposed on the gel during moisture changes and will not be a property of the gel itself. The restraints may, however, be inherent in the form in which the gel usually occurs and evidence is produced, for the case of wood, to show that shear stresses are likely to occur during actual drying or wetting.

H. H. HO.

256 541.182.6 : 537.363

The effect of electrolytes on the cataphoretic mobility of colloidal carbon. TS'AI LIU-SHENG AND CHIANG SHIH-HSIEN. *J. Phys. Chem.*, 45, pp. 1093-1103, Oct., 1941.—Data are given for the solubility of silver acetate in 20, 30, and 50% dioxane-water mixtures in the presence of NaNO₃ and NaClO₃ as added electrolytes. The Debye-Hückel limiting law holds through the range of dielectric constant covered (78 to 34). The equation, modified for the effect of ionic size, is also seen to hold approx. for the solubilities over the range studied, on the basis of the approx. constancy of the parameter a , the effective ionic diameter, calculated from the data. Using values of the average ionic diameter and of S_0 , the solubility in zero ionic strength, derived from the data, the Born equation was tested directly on the limiting solubilities, S_0 ; the agreement, however, is the same as that obtained on the observed solubilities, corrected theoretically for interionic effects. The activity coefficient of silver acetate in its pure saturated solution is approx. con-

stant (0.80 to 0.73). This is further evidence of the regularity, previously noted, of the constancy of the activity coefficient of slightly soluble electrolytes at saturation in pure solvents, irrespective of dielectric constant, on the basis of which the solubility of the electrolyte can be related to the dielectric constant of the solvent by the simple equation, $S_1/S_2 = (D_1/D_2)^3$. An analogy is reported between the rule of constant activity coefficient for electrolytes at saturation, independent of dielectric constant, and a similar rule for the constancy of the activity coefficient of electrolytes required for the coagulation of a given lyophobic sol, likewise independent of the dielectric constant.

257

541.182.6

Investigation of tellurium and arsenic sulphide in the colloidal state. BOSE, H. *Indian J. Phys.*, 15, pp. 277-287, Aug., 1941.—With a view to obtaining information on the nature of colloidal particles with special attention to their changes due to slow coagulation in ageing, the following samples of Te were examined by X-rays: (a) Coagulum by HNO₃ from a fresh Te sol, (b) coagulum by HNO₃ from a heated sol, (c) dried-up gummy mass, (d) electrolytic precipitate from aged sol, (e) electrolytic precipitate from aged heated sol, (f) thin film of Te that settles on the surface of the sol on allowing it to dry in a basin. The coagulum from a freshly prepared Te sol by HNO₃ was found to be amorphous, while the diffraction pattern of the coagulum of aged sol—specially the pattern of the sample mentioned in (f)—gives scope for suspecting the existence of a new variety of Te in it. Similar experiments with arsenic sulphide sol show that the natural peptizable precipitate and the electrolytic precipitate (by HCl) from a fresh sol yield amorphous bands, while that from heated sol or obtained by drying the sol gives crystalline pattern.

258

541.182.6 : 535.343.3

The absorption spectrum of suspensions of carbon black. WELLS, A. J., AND SMITH, W. R. *J. Phys. Chem.*, 45, pp. 1055-1060, Oct., 1941.—It has been suggested that the shape of the spectral transmission curve in the visible and near infra-red for dilute suspensions of carbon black is a function of particle size and size distribution. In the present work the transmission of carbon-black suspensions is studied from 25 μ to 0.24 μ . Existing formulae are a poor fit for the results obtained and it is concluded that the method is unsatisfactory for carbon blacks of the type employed.

A. H.

259

541.182.6.046.7

Ion effects on the rate of settling of fine-grained sediments. DREVESKRACHT, L. R., AND THIEL, G. A. *Amer. J. Sci.*, 239, pp. 689-700, Oct., 1941.—Ten different types of fine-grained sediments were deflocculated and subjected to the influence of ions of

Na^+ , K^+ , and Mg^{++} in various concentrations. The effects on the rate of settling and on the thickness of the resulting sediments are recorded.

260

541.182.63 : 535.34 : 538.615

Theory of the optical and magnetic properties of ferro-magnetic suspensions. ELMORE, W. C. *Phys. Rev.*, 60, pp. 593-596, Oct. 15, 1941.—The theory of the optical transparency of ferromagnetic suspensions, as modified by magnetic fields, is developed [see Abstr. 1519 (1940)]. The average shape of the particles is determined by measuring the transmission of a suspension in various directions while the particles are magnetically aligned parallel to one another. From this information the complete magneto-optic behaviour of the suspension can be deduced; comparison between experimental and theoretical curves gives a value of the (average) magnetic moment of the particles. In addition, theory for 2 new magneto-optic experiments is developed, one which will give directly the intensity of magnetization of the particles, the other which will give directly the volume of the particles. In the first experiment changes in transparency are used to indicate when the particles have been rotated magnetically through a definite angle; the second experiment is based on the changes in transparency accompanying the return to random particle orientation following the removal of an applied magnetic field. It is shown that suspensions should have a transmission of $(1/e)$ to give a max. magneto-optic effect.

261

541.183.23

Exchange forces between neutral molecules and a metal surface. POLLARD, W. G. *Phys. Rev.*, 60, pp. 578-585, Oct. 15, 1941.—A Heitler-London treatment of the exchange part of the mutual energy of a neutral atom and a metal is developed. The resulting interactions are evaluated on the basis of a simplified model of the metal and lead to a convenient and simple expression for the total exchange energy. This expression is applied to the interaction of H_2 and He with metals and is found to represent a repulsion. By adding this exchange interaction to the attractive van der Waals interaction between the molecule and the metal, a potential curve of the usual type, possessing a min., is obtained for each system. The depths of these min. are compared with observed heats of van der Waals adsorption. A discussion is given of the effects of the simplifications and approximations employed.

262

541.183.25

Chromatography of solutions containing a single solute. CASSIDY, H. G., AND WOOD, S. E. *J. Amer. Chem. Soc.*, 63, pp. 2628-2630, Oct., 1941.—It is shown in a simple case that the chromatography of a solution containing a single solute is in reasonable agreement with the theory.

263

541.183.25

Adsorption analysis. IV. Separation of mixtures of higher saturated fatty acids. CASSIDY, H. G. *J. Amer. Chem. Soc.*, 63, pp. 2735-2739, Oct., 1941.

264

541.183.26 : 621.385.032.24

Adsorption properties of metallic zirconium for gases and its applications to electron tubes. HUKAGAWA, S., AND NAMBO, J. *Electrotechn. J.*, 5, pp. 27-30, Feb., 1941.—Zr powder is mixed and suspended with a binder in xylene and sprayed on to a Mo plate. On heating to about 1100°C . the Zr adheres firmly to the plate. Experiments with such plates showed that Zr so treated absorbs such unwanted gases as N_2 , O_2 , H_2 , and CO very considerably, the optimum temperature ranging from about 400° to 600°C . Zr does not absorb the rare gases to any marked extent. The absorbing properties of Zr can be utilized for the clean-up of residual gases in electron tubes by spraying suitable parts of the interior of the tube and applying heat treatment. Zr spraying treatment of grids is found effective in reducing secondary electron emission. The non-absorption of the rare gases can be used to purify gases employed in the manufacture of discharge tubes. In certain valves the de-gassing action of the Zr, combined with the decreased secondary electron emission and increased anode dissipation, gave both increased efficiency and doubled the average life of the valves. A. W.

265

541.183.26

Adsorption. I. The effect of heat treatment on the low-temperature adsorption of nitrogen by aluminium oxide. KRIEGER, K. A. *J. Amer. Chem. Soc.*, 63, pp. 2712-2714, Oct., 1941.—(1) The effect of preheating upon the surface area of a sample of aluminium oxide and upon the heat of adsorption of nitrogen on the surface has been measured. (2) Tentative explanations of the observed phenomena have been given.

266

541.24 = 3

Distribution functions of polymolecular substances and their determination by subdivision into fractions. SCHULZ, G. V. *Z. phys. Chem. B*, 47, pp. 155-193, Sept., 1940.—After defining different distribution functions—frequency distribution, mass distribution and integral distribution—expressions are derived for mean mol. wt. and different average values of mol. wt./as determined by different methods, e.g. viscosity, osmotic pressure, ultracentrifuging. The conditions are stated, to which the fractionizing must conform in order to be suitable for determining the distribution function. Using the approx. equation previously derived [Abstr. 722 (1941)] the composition of fractions is calculated by means of the mass distribution function. To simplify matters a semi-graphic method is developed, based on the assumption that the distribution of the mol. wts. follows approx. the Gauss

curve. The question whether a given substance is molecularly uniform or polymolecular may be decided by fractionizing, but only within certain limits, which are discussed.

R. N.

267

541.61

The common basis of intramolecular rearrangements.

VIII. The formation of cyclopropanes from mono-halides and sodium. II. The formation of 1,1,2-trimethylcyclopropane from 1-chloro-2,2-dimethylbutane. WHITMORE, F. C., AND CARNEY, T. P. *J. Amer. Chem. Soc.*, 63, pp. 2633-2635, Oct., 1941.

268

541.634

The reduction of multiple carbon-carbon bonds.

III. Further studies on the preparation of olefins from acetylenes. CAMPBELL, K. N., AND EBY, L. T. *J. Amer. Chem. Soc.*, 63, pp. 2683-2685, Oct., 1941.

269

541.634

cis-trans isomerizations. I. The mechanism of a catalysed isomerization of maleic acid to fumaric acid. NOZAKI, K., AND OGG, JR., R. II. The mechanism of the amine catalysed isomerization of diethyl maleate. NOZAKI, K. *J. Amer. Chem. Soc.*, 63, pp. 2583-2586 and 2681-2683, Oct., 1941.—A mechanism is proposed (1) for the isomerization of maleic acid to fumaric acid catalysed by inorganic acids and salts, (2) for the amine-catalysed isomerization of diethyl maleate. Experimental observations are shown to be in agreement with the mechanism. The applicability of the mechanism to other *cis-trans* isomerizations is discussed.

270

541.64

The mechanism of the peroxide-catalysed polymerization of *d-s*-butyl α -chloroacrylate. PRICE, C. C., AND KELL, R. W. *J. Amer. Chem. Soc.*, 63, pp. 2798-2801, Oct., 1941.—An investigation of the kinetics of the benzoyl peroxide-catalysed polymerization of *d-s*-butyl α -chloroacrylate in dilute dioxane solution has shown the rate of the reaction to be accurately proportional to the monomer concentration and to the square root of the catalyst concentration. The results are in agreement with the generally accepted mechanism for macropolymerization involving a free radical-chain reaction. It has been suggested that, for polymerizations catalysed by benzoyl peroxide, the chain is initiated by free radicals formed by thermal decomposition of the catalyst.

271

541.64

Fractionation and size distribution in vinyl acetate polymers. BLEASE, R. A., AND TUCKETT, R. F. *Trans. Faraday Soc.*, 37, pp. 571-580, Nov., 1941.—Commercial polyvinyl acetates of 3 different average chain lengths have been fractionated from toluene solution by a precipitation method using a methanol-water mixture. The fractionation data are in fair agreement with Schulz's theory of the solubility of high mol. wt. substances. From the size-distribution

data obtained in this way, combined with the Melville-Gee theory of the kinetics of polymerization, it is concluded that the growing chains are most probably terminated by mutual collision, in agreement with the purely kinetic data.

272

541.653.4

Sugar acetates, acetylglucosyl halides, and orthoacetates in relation to the Walden inversion. FRUSH, H. L., AND ISBELL, H. S. *J. Res. Nat. Bur. Stand., Wash.*, 27, pp. 413-428, Nov., 1941.

273

541.67 = 3

Dielectric polarization and association of alicyclic alcohols. HÜCKEL, W., AND SCHNEIDER, I. *Z. phys. Chem. B*, 47, pp. 227-244, Oct., 1940.—Debye's assumption of 2 different kinds of association, quadrupole and chain association, is used to explain the relations between orientation polarization and concentration of secondary alicyclic alcohols dissolved in benzene or cyclohexane. A distinction is made between alcohols with more or with less steric hindrance. For the former orientation polarization and association as determined by the cryoscopic method are in good agreement for small concentrations, if it is assumed that the association leads to double molecules without dipole moment. For the latter the trend of the curves is explained for small concentrations by the formation of chain-associated in addition to quadrupole double molecules. Relations are discussed between the dielectric constants of the alcohols and the trend of the curves for orientation polarization. The higher the point of intersection of the curves with the ordinate representing the pure alcohol, the higher the dielectric constant.

R. N.

274

541.67 : 537.226.1 : 621.315.616.96

Electrical properties of solids. XI. Polyvinyl acetate and polyvinyl chloroacetate. MEAD, D. J., AND FUOSS, R. M. *J. Amer. Chem. Soc.*, 63, pp. 2832-2840, Oct., 1941.—The electrical properties of polyvinyl chloroacetate from -80° to $+70^{\circ}$ are given for the (approx.) frequency range 60 c./s. to 10 kc./s. The moment per monomer unit was found to be 4.9×10^{-18} . The electrical properties of two polyvinyl acetates (Gelva) of different mol. wts. are given for 30° to 100° over the same frequency range. The moment per monomer unit was found to be 2.3×10^{-18} for both polymers. These polymers, in the high-temperature range, exhibit absorption due to dipole rotation. The times of relaxation are distributed about a value which is proportional to the molecular weight of the polymer. Further evidence is advanced that the d.c. conductance can be used as a measure of the internal viscosity of plastics: both the d.c. conductance and the time of polar relaxation are exponential in $1/T$ and have approx. the same temperature coefficient. A number of puzzling features in the electrical properties, which appear

when the period of the impressed field is short compared with the time of elastic relaxation in the system, are pointed out. Some tentative explanations are proposed, and an experimental attack is suggested. [See Abstr. 662 B (1941)].

275

541.72

Studies of the preparation and allotropic transformation of lead monoxide. PETERSEN, M. *J. Amer. Chem. Soc.*, 63, pp. 2619-2620, Oct., 1941.—When hydrated PbO is dehydrated in a vacuum at about 120°, varied fractions of the resulting oxide are obtained in the yellow, orthorhombic form, depending on the original state of the hydrate. The most finely precipitated hydrates yield almost pure yellow, the coarsest nearly pure red, tetragonal oxide. When carbonates are decomposed in a vacuum at about 250°, a similar dependence of yield of yellow oxide on particle size is found, but the proportion of yellow is less than that from hydrates, save the coarsest. The temperature of the boundary between red and yellow stability is $489^\circ \pm 1$ deg. Two preparations of yellow oxide of different habit of growth give X-ray powder patterns in which only a barely measurable difference, perhaps not significant, is found. From these data the lattice dimensions are given.

276

541.8

The solubilities of hydrogen chloride and hydrogen bromide in carbon tetrachloride and in chloroform. HOWLAND, JR., J. J., MILLER, D. R., AND WILLARD, J. E. *J. Amer. Chem. Soc.*, 63, pp. 2807-2811, Oct., 1941.—The solubilities of HCl and HBr in CCl_4 and in chloroform have been determined at 0, 15° and 25° at pressures below 1 atm. The solubility in each case is proportional to the partial pressure of the solute. All of the solutions show positive deviations from Raoult's law. A solubility apparatus which offers certain advantages in the investigation of gaseous solutes which can be determined chemically is described.

277

541.8 = 3

Influence of degree of dispersity on solubility of crystallized substances. COHEN, E., AND BLEKKINGH, JR., J. J. A. *Z. phys. Chem. A*, 186, pp. 257-281, June, 1940.—The so-called dispersity effect may cause an increase of concentration of a solution, if the dissolvent substance has undergone a mechanical process of crushing. To this is attributed the variation in values of the solubility of BaSO_4 . The dispersity effect may be avoided by a suitable filtering of the saturated solution. Conductivity and polarographic measurements proved that the degree of dispersity does not affect the solubility of crystallized, chemically and physically pure BaSO_4 .

R. N.

278

541.8

Studies on high-molecular-weight aliphatic amines and their salts. III. Behaviour of the acetates of dodecylamine and octadecylamine in water. RAL-

STON, A. W., HOERR, C. W., AND HOFFMAN, E. J. *J. Amer. Chem. Soc.*, 63, pp. 2576-2579, Oct., 1941.—These amine salts show crystalloidal properties in dilute aqueous solutions and colloidal properties in concentrated solutions.

279

541.8 : 535.34 = 3

On light absorption of solutions of cobalt rhodamide. KISS, Á. VON, AND CSOKÁN, P. *Z. phys. Chem. A*, 186, pp. 239-247, May, 1940.—With a method previously described [Abstr. 4531 (1937)] extinction curves are taken for wavelengths between 200 and 700 m μ at room temperature for aqueous solutions of KSCN, $\text{Co}(\text{SCN})_2$ and CoSO_4 , also those of $\text{Co}(\text{SCN})_2$ in various concentrations of KSCN and in CoSO_4 , NaClO_4 , NaNO_3 , $\text{Ca}(\text{NO}_3)_2$ or MgSO_4 . As reference curve that of $\text{Co}(\text{ClO}_4)_2$ which is independent of concentration, was used. The various complex formations, their constitution, dissociation and dehydration, are discussed. [See Abstr. 2101 (1941)].

R. N.

See Abstr. 120

541.8 : 536.51

280

541.8 : 536.7

The partial pressure of hydrogen chloride from its solutions in some aprotic solvents and the calculation of the heat and entropy of solution. O'BRIEN, S. J. *J. Amer. Chem. Soc.*, 63, pp. 2709-2712, Oct., 1941.—Measurements are reported of the partial vapour pressure of HCl from its solutions in benzene and in chlorobenzene at 30° and 40°, and in nitrobenzene at 20°, 25°, 30° and 40°. These include new measurements for nitrobenzene solutions at 25° and for benzene solutions at 30°. A comparison of the derived thermodynamic data with infra-red absorption data suggests a straight-line relationship between the entropy change of the solute and the shift in its 3.46 μ vibrational band produced by the solvent.

281

541.8 : 541.124

Complex ions. II. The stability and activity coefficients of the silver-ammonia ion. DERR, P. F., STOCKDALE, R. M., AND VOSBURGH, W. C. *J. Amer. Chem. Soc.*, 63, pp. 2670-2674, Oct., 1941.—Previous measurements of the solubility of AgIO_3 in solutions of KNO_3 have been checked. The solubility of AgIO_3 in NH_3 solutions has been determined. The instability constant of the diammine-silver ion calculated from the solubility data agreed with the best of the previous results. Assumption of equality of the activity coefficients of the silver and diammine-silver ions gave consistent results. Measurements of the solubility of AgCl_2 in NH_3 solutions containing KNO_3 or KCl showed that the solubility is dependent on the chloride ion concentration as well as on the ammonia concentration and the ionic strength.

282

541.8 : 541.124

Velocity of intersolvate exchange reactions. WAHL, A. C., AND SEABORG, G. T. *J. Amer. Chem. Soc.*, 63, p. 2849, Oct., 1941.

PRACTICAL CHEMISTRY

283 542.2 531.7 535.8 536.6 621.317

Instrumental methods of chemical analysis. MÜLLER, R. H. *Industr. Engng Chem. (Analytical Edition)*, 13, pp. 667-754, Oct., 1941.—A comprehensive illustrated survey of the present state of the field.

284 542.4

The drying of gases by activated alumina. *Engineering*, 152, pp. 406-407, Nov. 21, 1941.—Activated alumina has been found to possess a number of advantages over other drying agents for air and other gases; and consists essentially of alumina in a porous amorphous form which is then capable of desiccating gases to a moisture content of 0.005 gr./ft.³, and of adsorbing up to about 20% of its mass of water. The particles of material, which are available in a wide range of sizes and are chemically inert to many reagents, are highly resistant to mechanical shock, and will undergo repeated cycles of adsorption and reactivation without crumbling or loss of adsorptive efficiency. The principle employed in industrial plants is described in detail and illustrated by flow diagrams. Units are available in a series of standard sizes capable of handling gas flows ranging from 100 ft.³ to 15 000 ft.³/hr. The Birlcet Lectrodryer, which is the standard plant, is now employed for drying air, hydrogen, CO₂ for the manufacture of dry ice, and in connection with air-conditioning. Reactivation of the alumina is effected simply by heating the spent alumina to a temperature above 180°C.

285 542.48

Distillation of sugar propionates at low pressures. HURD, C. D., LIGGETT, R. W., AND GORDON, K. M. *J. Amer. Chem. Soc.*, 63, pp. 2656-2657, Oct., 1941.—An apparatus is described and the procedure outlined for the distillation of propionates of mono-, di- and trisaccharides.

286 542.63

Separation of isotopes by thermal diffusion. I. Preliminary test of the separation column. II. Separation of chlorine isotopes. AKABORI, H., HUSIMI, K., ITOH, I., KIKUCHI, S., KO, Y., KOBAYASHI, M., MOMOTA, T., NAGAOKA, H., OKAZAKI, M., SUEHRO, I., TAKEDA, E., TAKETANI, M., UTIYAMA, T., WAKATUKI, T., WATASE, Y., YAMAGUCHI, S., AND YUKAWA, I. *Proc. Phys.-Math. Soc. Japan*, 23, pp. 590-604, Aug., 1941.—Some fundamental properties of the thermal diffusion column were studied with a 2 m. tube. The separation factor increased considerably with increase of temperature difference, with a max. value at a certain temperature. A 7.5 m. tube was constructed and the performance of the column was confirmed by the separation of oxygen from the air. During this separation, concentration of argon in the air was observed. The separation of the Cl isotopes was made with a 7.5 m. column. The

heavy sample contained 44% of the heavier isotope Cl³⁷ and the light sample contained 8%. The measurement of the constitution of the isotopes was made by a gas density-meter of a new type.

287 542.65

An attempted isotopic separation by fractional crystallization. ORR, W. J. C. *Trans. Faraday Soc.*, 37, pp. 587-590, Nov., 1941.—The design of a continuous counter-flow system to deal with a crystalline phase and its saturated solution, which was developed during an attempt to fractionate isotopes by fractional crystallization, is described. Using NaCl solutions, no detectable separation of the Cl isotopes was obtained.

CRYSTALLOGRAPHY

288 548 : 534.01

Elastic waves in crystals. SAKADI, Z. *Proc. Phys.-Math. Soc. Japan*, 23, pp. 539-547, July, 1941.—A mathematical treatment is given of the propagation of elastic waves in crystals and formulae are derived for the velocities of the longitudinal and transverse waves and the direction of oscillation of the latter for regular tetragonal, hexagonal and trigonal systems.

A. W.

289 548 : 535.215.4

An anomalous crystal photo-effect in d-tartaric acid single crystals. CHUNG KWAI LUI. *Phys. Rev.*, 60, pp. 529-531, Oct. 1, 1941.—Brady and Moore observed that certain crystals which appeared to have flaws and were not very transparent gave a current response which started out in one direction just after the light was turned on, decreased rapidly with time of illumination, and then flowed in the opposite direction. This phenomenon has been investigated in detail. All clear, well-formed, single crystals exhibit this current-reversal phenomenon when light falls on certain points of the crystal surface. These points always lie between 2 regions which respond with normal current flows in opposite directions. The superposition of the 2 normal current-response curves gives a resultant which agrees with the observed current-reversal curve within the experimental error. The various current-response curves for different illuminated faces of the crystal, including the current-reversal effect, are correlated by assuming a particular direction in the unit-cell of the crystal for which the electrical conductivity is a max.

290 548 : 535.37 + 535.4

Luminescence, absorption and scattering of light in diamonds. I. Fluorescence. II. Phosphorescence. III. Absorption. NAYAR, P. G. N. *Proc. Indian Acad. Sci. A*, 13, pp. 483-497 and 534-542, June, and 14, pp. 1-17, July, 1941.—A dozen specimens of diamond, varying widely in colour and perfection, were used in this study. The fluorescence spectrum consisted in every case of a sharp band at 4 156 Å, with

discrete, rather diffuse, bands at 4 278, 4 387, 4 514 and 4 643 Å, superposed on a feeble continuous spectrum extending to 6 300 Å. The intensity of fluorescence, however, varied widely over a range of the order of 10 000 to 1. The complete spectrum was excited by any wavelength up to 4 156 Å and was particularly bright for excitation by this wavelength. For any greater wavelength the fluorescence spectrum disappeared completely. The phosphorescence spectrum was found to be similar to the fluorescence spectrum, except that the continuum between 5 050 and 6 300 Å had nearly the same intensity as the region of discrete bands. It was possible to show that the true fluorescence consisted solely of the discrete bands. In the phosphorescence spectrum the band at 4 156 Å could be excited by a slightly greater wavelength, i.e. as an anti-Stokes band. The absorption spectrum of the diamonds was found to contain a sharp band at 4 156 Å and a series of diffuse bands on the short-wave side, corresponding to the diffuse bands on the long-wave side of 4 156 Å in the fluorescence spectrum. The displacements of the diffuse bands from 4 156 were found to correspond to the frequencies of the weak infra-red absorptions known to be exhibited by diamonds. The intensity of the band system in absorption varied directly with the intensity of fluorescence. The connection between absorption and fluorescence spectra is explained by considering 4 156 as the principal electronic transition of the active centre in diamond luminescence, and the diffuse band systems as arising from combinations with lattice vibration frequencies. It is considered that local imperfections in the lattice, rather than possible impurities, are responsible for the band at 4 156. The observed absorption in diamond is not consistent with the electronic energy levels obtained theoretically by Kimbell. Kimbell, however, assumed an ideal lattice.

W. S. S.

291

548 : 537.531 : 535.3

On the geometry of the quantum reflection of X-rays in diamond. PISHAROTY, P. R. *Proc. Indian Acad. Sci. A*, 14, pp. 56-68, July, 1941.—The paper deals with the purely geometrical aspects of the Raman reflections from the (111) planes of diamond based on the Raman-Nath formula. The round shape of the spots obtained over a wide range of the setting of the crystal, as contrasted with the elliptic shape of the Laue reflections, is explained as a purely geometrical consequence of the divergence of the incident pencil and the special law of reflection. The appearance of quantum reflections outside the plane of incidence, in cases when it is not a plane of symmetry, is worked out quantitatively, and the agreement with observation is a striking evidence of the definite orientations of the phase waves associated with the lattice vibrations in this case. The various quantitative formulae derived are found to be in accord with experimental facts.

A. H.

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292

548 : 538.221

The relation between atomic arrangement and coercivity in an alloy of iron and platinum. LIPSON, H., SHOENBERG, D., AND STUPART, G. V. *J. Inst. Met.*, 67, pp. 333-340, Nov., 1941.—A state of very high coercivity can be produced in an alloy containing equal atomic proportions of Fe and Pt, and the present investigation was undertaken in order to see if the atomic arrangement in the alloy could produce any explanation of this in the light of recent magnetic theory. The crystal structure of the alloy was found, from an X-ray powder photograph, to be ordered face-centred tetragonal of the same type as AuCu. The lump specimens, also, were found to possess this structure for all heat-treatments, in contrast to the statements of previous workers that they could exist in 2-phase form. At very high temperatures, however, it is probable that the alloy is face-centred cubic, though this state cannot be maintained by quenching. The coercivity is greatly influenced by heat treatment. The highest coercivity produced was of the order of 1 200 gauss, and the lowest of the order of 150 gauss; these two states were found to be associated with characteristic microstructures. The microstructure of the state of high coercivity shows crystal grains crossed by sets of parallel bands, and these are interpreted as twinning bands due to the breakdown of the high-temperature cubic form. This conclusion is supported by X-ray evidence. Since the final structure is tetragonal, very large strains must be set up in the attempt to make the atoms approximate to their original cubic positions, and these strains may be the cause of the high coercivity.

293

548.73

Allotropes of tellurium by X-ray diffraction method. BOSE, H., AND RAY, B. B. *Indian J. Phys.*, 15, pp. 233-240, June, 1941.—The structure of Te prepared by different methods was analysed by X-rays. The precipitated Te was supposed to be amorphous, but X-ray examination revealed that it is the hexagonal variety in a finely divided state. The diffraction patterns were taken at different temperatures and the results contradict the hypothesis of the existence of 2 dynamic allotropes in ordinary Te. These experiments agree with the view put forward by Damiens. On chilling molten Te it falls to a fine powder, but even this sample is not amorphous. It was generally believed that a beam of X-rays changes the crystal structure of ordinary Te affecting its sp. ht. by about 8%, but no such change in the structure could be detected.

294

548.73 : 669.14

On the nature of a satellite in the X-ray pattern of α -crystals, and the differentiation of a new phase α' by the surface-recrystallization method in certain ternary alloys. I. The Fe-Ni-Al system. KIURI, S. *Rep. Aero. Res. Inst. Tokyo*, No. 207, pp. 167-204,

April, 1941.—Certain contradictions in Köster's equilibrium diagram for Fe-Ni-Al are pointed out, and it is considered that magnetic hardening is due to the separation of a new α' -phase from the α -solid solution. The appearance of satellite lines is regarded as indicative of the preliminary stage of the separation of this new phase. It is concluded that the new phase is body-centred cubic. J. T.

295

548.73:669.14

An X-ray study on the mechanism of the splitting phenomenon of α -crystals in the interiors of some ternary alloys. I. The Fe-Ni-Al system, KIUTI, S. *Rep. Aero. Res. Inst. Tokyo*, No. 209, pp. 271-298, May, 1941.—By X-ray examination of the α -phase, the specimens having been annealed for a prolonged period (3 500 hrs.), it is shown that the splitting of the lines of the X-ray photograph may be observed from the inside of the specimen as well as from the surface. The equilibrium diagram, previously based on the results of dilatometric, magnetometric and microscopic analyses, is confirmed. J. T.

GEOPHYSICS

296

550.34 (52)

Sensible earthquakes in Tokyo (July 1-December 31, 1939). *Seismometr. Rep. Earthquake Res. Inst. Tokyo*, Nos. 3-4, pp. 17-26, 1939.

297

550.34 (778)

A contribution to the seismic history of Missouri. HEINRICH, R. R. *Bull. Seism. Soc. Amer.*, 31, pp. 187-224, July, 1941.—Earthquakes occurring in Missouri since 1816 are catalogued, and statistical tables prepared; 7½% of the quakes were strong enough to endanger life; 60% of all the earthquakes occurred in the New Madrid Area and 25% in the region of St. Mary's Fault. W. A. R.

298

550.34 (794)

Seismic activity in the Imperial Valley, California. WOOD, H. O. *Bull. Seism. Soc. Amer.*, 31, pp. 245-254, July, 1941.

299

550.34 : 621.385.8

The use of the thyratron in an earthquake-alarm system. SULKOWSKI, E. L. *Bull. Seism. Soc. Amer.*, 31, pp. 239-244, July, 1941.—A thyratron is used as a power valve to provide sufficient output from a seismograph to operate an alarm, both visual and audible. E. H. W. B.

300

550.34 : 551.465

Sea-level changes as trigger forces. LEYPOLDT, H. *Bull. Seism. Soc. Amer.*, 31, pp. 233-238, July, 1941.—Curves are obtained for the seasonal variations in the level of the sea at several American stations. These mean values indicate that the change of loading must effect a change in the moment of inertia of the rotating spheroid, causing the annual, and probably secular, change in latitude as well as variations in the internal stresses. Earthquakes may then be the

release of stressed areas, the stressing of which may have been caused in part by these load changes, which also form the trigger forces. R. S. R.

301

550.341.4

The estimation of focal depth from macroseismic data. BLAKE, A. *Bull. Seism. Soc. Amer.*, 31, pp. 225-231, July, 1941.—Formulae used for estimating focal depth are compared and criticized. The introduction of an absorption factor to correct the inverse-square law of intensity reduction is not satisfactory. The assumption of straight-ray propagation needs reconsideration. Modern measurements should provide data for dealing with doubtful factors, such as the horizontal component of the S-wave, the effect of subsoil in modifying earthquake intensity, etc. W. A. R.

302

550.384.42

The variability of lunar magnetic variation. SCHNEIDER, O. *Terr. Magn. Atmos. Elect.*, 46, pp. 283-300, Sept., 1941.—A possible way of localizing the lunar diurnal variation L in the ionosphere is by studying its variability and its relations to the solar variation S . This problem is complicated by the impossibility of separating 2 oscillations of so nearly equal wavelength. Instead of deviations on individual days, the mean variability of L is investigated. The question is analysed in harmonic dials which contain Fourier coefficients grouped into elliptical point-clouds. The ellipses representing such frequency distributions would follow a periodicity with a wavelength of about a week if the statistical fluctuations of S and of L were completely independent of one another; if there existed a strict correlation by which phase shifts and relative-amplitude deviations of the solar and lunar waves were connected, the period of that oscillation in the parameters of the elliptical distributions should be semi-monthly. A mathematical model is suggested for an intermediate stage which allows for any proportion between 2 such parts of the L -variability, one correlated and the other independent. By means of empirical data from Batavia it is shown that very large series of observations would be necessary for proving the validity of the model; preliminary results confirm that the variability of L contains a considerable independent part, not correlated with S .

303

550.385.1

Principal magnetic storms. *Terr. Magn. Atmos. Elect.*, 46, pp. 368-374, Sept., 1941.

304

550.389.12 = 3

International magnetic character-numbers, 1940. BARTELS, J. *Terr. Magn. Atmos. Elect.*, 46, pp. 345-346, Sept., 1941.

305

550.389.12 (98)

New magnetic character-numbers for the polar station Gjøahavn for 1904. WASSERFALL, K. F. *Terr. Magn. Atmos. Elect.*, 46, pp. 309-311, Sept., 1941.

- 306 550.389.13
American *URSI* broadcasts of cosmic data, giving American magnetic character-figure, *CA*, three-hour-range indices, *K*, and mean *K*-indices, *KA*, for April to June, 1941. JOHNSTON, H. F. *Terr. Magn. Atmos. Elect.*, 46, pp. 360-364, Sept., 1941.
- 307 550.389.13
Three-hour-range indices, *K*, for 12 magnetic observatories, July to December, 1940, and summary for 1940. JOHNSTON, H. F. *Terr. Magn. Atmos. Elect.*, 46, pp. 301-308, Sept., 1941.
- 308 550.389.13 (47)
K-index according to the U.S.S.R. observatories. BENKOVA, N. P., AND KOSHIA, O. Y. *Terr. Magn. Atmos. Elect.*, 46, pp. 343-344, Sept., 1941.
- 309 550.389.13 (794) : 523.74
Solar and magnetic data, April to June, 1941, Mount Wilson Observatory. NICHOLSON, S. B., AND MULDER, E. S. *Terr. Magn. Atmos. Elect.*, 46, pp. 364-366, Sept., 1941.
- 310 550.389.14 (687)
Cape Town magnetic data. OGG, A. *Terr. Magn. Atmos. Elect.*, 46, p. 364, Sept., 1941.
- 311 550.389.222 (72)
Results of magnetic observations in Mexico, May, 1941. GALLO, J. *Terr. Magn. Atmos. Elect.*, 46, p. 357, Sept., 1941.
- 312 551.2
The interior of the earth viewed in its relation to earthquake causes. The viewpoint of seismology. HODGSON, E. A. *J. Roy. Astr. Soc. Can.*, 35, pp. 321-329, Oct., 1941.
- 313 551.46 (265)
The Pacific Ocean. SVERDRUP, H. U. *Science*, 94, pp. 287-293, Sept. 26, 1941.—The structure of the water-masses of the Pacific and the relations of the prevailing currents to this structure are analysed. Only a thin layer of the surface of this ocean is heated, and the enormous water-masses that fill the deep basins are cold. Nowhere in the Pacific is surface water observed to sink, and the deep water in the Pacific originates mainly from the Atlantic, where sinking of surface water takes place. The equatorial counter current is the result of the heaping-up of surface waters in the west by the trade winds. The rise from E. to W. is 65 cm. W. A. R.
See Abstr. 300 551.465 : 550.34
- 314 551.508.77
Calibration of a weather bureau tipping-bucket rain-gauge. PARSONS, D. A. *Mon. Weath. Rev.*, Wash., 69, pp. 205-206, July, 1941.
- 315 551.510.535 (53)
Critical frequencies and virtual heights of the ionosphere, observed by the National Bureau of Standards at Washington, D.C., April to June, 1941.—*Terr. Magn. Atmos. Elect.*, 46, pp. 357-359, Sept., 1941.
- 316 551.510.535 (85)
The ionosphere at Huancayo, Peru, April to June, 1941. LEDIG, P. G., COILE, R. C., AND JONES, M. W. *Terr. Magn. Atmos. Elect.*, 46, pp. 351-354, Sept., 1941.
- 317 551.510.535 (941)
The ionosphere at Watheroo, W. Australia, April to June, 1941. PARKINSON, W. C. *Terr. Magn. Atmos. Elect.*, 46, pp. 347-350, Sept., 1941.
- 318 551.510.535 : 523.72 : 621.396.812.5
The sun and the ionosphere. CHAPMAN, S. *J. Instn. Elect. Engrs*, 88, Part I, pp. 400-413, Nov., 1941.—The thirty-second Kelvin lecture.
- 319 551.515
An alternative form of potential vorticity. ARAKAWA, H. *Mon. Weath. Rev.*, Wash., 69, p. 206, July, 1941.
- 320 551.521.1 (7)
Solar radiation and sunspot data for July, 1941. *Mon. Weath. Rev.*, Wash., 69, pp. 224-227, July, 1941.
- 321 551.574.7
Experiments on condensation nuclei. NOLAN, P. J. *Proc. Roy. Irish Acad.*, 47A, 2, pp. 25-38, Oct., 1941.—The distribution of charge on atmospheric nuclei under controllable conditions was determined. The nuclei were enclosed in a gasometer and experiments were carried out with varying conditions of humidity, age and concentration of nuclei. When atmospheric nuclei are stored the value of Z/N_0 (ratio of concentrations of total to uncharged nuclei) increases with time from 1.9 to a final value between 2.5 and 3.5. The final value, which is reached in between 7 and 17 hrs., depends on the initial concentration of the nuclei, being small for very low concentrations. The initial value of Z/N_0 appears to be independent of humidity and concentration, but the final value is apparently slightly smaller for dry air. The rate of decay of atmospheric nuclei in a closed vessel corresponds with the equation, $dZ/dt = -\gamma Z^2 - \lambda Z$. The value of γ is found to agree within the expected limits with Kennedy's value for flame nuclei. The partition of the λ term between diffusion and fall by gravity is discussed, and it is concluded that the exponential loss is mainly due to diffusion, taking place in a boundary layer. The thickness of the boundary layer is shown to vary directly as the square root of the linear dimensions of the vessel. The erroneous attribution of error to Aitken in certain publications is discussed. A statistical treatment of ratios of charged and uncharged nuclei is given. R. S. R.
- 322 551.582 (7)
Meteorological and climatological data for June, 1941. *Mon. Weath. Rev.*, Wash., 69, pp. 179-197, June, 1941.
- 323 551.582 (7)
Meteorological and climatological data for July

1941. *Mon. Weath. Rev., Wash.*, 69, pp. 206-224, July, 1941.

324 551.582 (77)

The midwest storm of November 11, 1940. KNARR, A. J. *Mon. Weath. Rev., Wash.*, 69, pp. 169-179, June, 1941.

325 551.576

Photographic studies of some cloud forms and their changes with time. CHIPLONKAR, M. W. *Sci. Notes India Met. Dep.*, 8, 94, pp. 113-116, 1941.—During the last 2 years the author has obtained photographs of some types of natural clouds at short intervals of time in order to study the changes which they undergo. Some of these, taken at Poona, are reproduced and discussed.

326 551.582 (547)

Frequency of thundery conditions at Bombay compared with those at some other stations in India. CHIPLONKAR, M. W. *Sci. Notes India Met. Dep.*, 8, 96, pp. 131-138, 1941.—Frequency distribution of thunderstorm activity at Bombay is studied over a period of 65 years. There are 2 hours of max. activity, one between 15 and 16 and the other between 21 and 22 hrs. There is also a subsidiary max. in the early morning, particularly in June, Sept. and Oct. In all months, during the night, the number of occasions of lightning alone is greater than that of thunder and lightning, the ratio of the former to the latter being greater during the drier months Nov. to May (generally more than 6:1) than during the wet months June to Oct. (2.3:1 to 1:1). Comparing the seasonal variation of thunderstorm activity with that of rainfall at the same station, it is found that their max. do not coincide, but the thunderstorm max. either precedes or follows the rainfall max., depending upon the season. No definite conclusions could be drawn regarding the secular variation.

327 551.582 (729)

The areal distribution of mean annual rainfall over the island of Hispaniola. ALPERT, L. *Mon. Weath. Rev., Wash.*, 69, pp. 201-204, July, 1941.

328 551.594.1

Electric currents in the atmosphere and their effects. HESS, V. F. *Trans. Electrochem. Soc.*, 79, pp. 347-353; *Disc.*, 353-354, 1941.—A survey of all existing vertical electric currents in the atmosphere (conduction current, convection current, lightning and brush discharge) is given and the problem of the maintenance of the electric field in the atmosphere is discussed. It is pointed out that, in regions electrically disturbed by lightning and point or glow discharge, considerable amounts of ozone are produced which may account for anomalies found in the ozone content of the lower strata of the atmosphere.

329 551.594.1 (941)

Atmospheric-electric results from Watheroo, W.

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Australia, for the period 1924-1934. WAIT, G. R., AND TORRESON, O. W. *Terr. Magn. Atmos. Elect.*, 46, pp. 319-342, Sept., 1941.—Atmospheric-electric data for the 11-year period are summarized and curves drawn showing the behaviour of the recorded elements and the calculated air-earth current through the day and year. The pronounced effect of smoke on the various elements from burning bush is illustrated and discussed. The calculated ratio of the columnar resistance of the air over Watheroo to that over the ocean shows a diurnal variation which has essentially the same character for all seasons of the year and also appears to be similar in character to that for Huancayo, Peru, and for Tucson, Arizona, when each is plotted on its own local time. The summer, but not the winter, potential-gradient diurnal variation is in good accord with that found over the ocean.

330 551.594.5

The Aurora of September 18, 1941. J. Franklin *Inst.*, 231, pp. 373-375, Oct., 1941.

331 551.594.5 (71)

Directional and diurnal characteristics of auroras at some places in Canada. CURRIE, B. W., AND JONES, C. K. *Terr. Magn. Atmos. Elect.*, 46, pp. 269-278, Sept., 1941.—Single-station photographs taken chiefly at Chesterfield, Cape Hope's Advance and Coppermine, during the second International Polar Year, are used to determine the position in space of well-defined quiet auroral arcs. Visual observations at the same stations are used for making similar estimates on more complex and more active displays. The results tabulated are the measured angles (all close to 90°) between the westward-directed ends of the auroral bands and the geomagnetic meridians through their midpoints. Statistical examination of the data shows symmetrical but flattened frequency curves. The angles increase with increasing geomagnetic longitude, show no certain variation with latitude, and are smaller for the visually observed active displays than for the photographically observed arcs. For examining diurnal characteristics, an auroral character-number is defined, and measured hourly during the observations. The peaks shown in the graphs of this number throughout the night are correlated with astronomic and geomagnetic midnight, and with longitude.

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332 583.7

A corollary to the ring hypotheses. IVES, R. L. *J. Franklin Inst.*, 231, pp. 357-363, Oct., 1941.—Permian circumpolar glaciations, suggested by some scattered evidence, may be explained as a result of temporarily increased atmospheric opacity, caused by the suspension, in the air, of some of the finer debris resulting from the disintegration of the terrestrial ring system postulated to explain the Permian circum-equatorial glaciations. A possible alternation of circumequatorial and circumpolar glaciations is suggested by this approach.

